THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. 34 AUGUST, 1935 No. 2

EXAMINATION OF THE MUCOSAL RELIEF AS A DIAGNOSTIC AID IN DISEASES OF THE GASTROINTESTINAL TRACT*

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THE development of roentgen diagnosis in diseases of the gastrointestinal tract within the last decade has been characterized by an increasing interest in the inner relief of the digestive tract. This type of examination has been given the name of "relief method."

This report intends to show some of the possibilities of this method, to show particularly the importance of this method not only for scientific purposes but more especially for routine use.

Historical Note. The early roentgenologists, especially Holzknecht and his school, watched the first swallow of the contrast meal as it flowed through the rugae of the body of the stomach. This procedure was also carried out by Carman and his school. Cole in 1909 demonstrated the rugae of the stomach by sedimentation, apparently for experimental purposes. v. Elischer's examinations in 1911 with small amounts of contrast medium were primarily physiological studies and had no influence on the examination of patients, although he stated the value of this method in the early diagnosis of small lesions. Other names to be mentioned here are those of Freud, Schwarz and Eisler and Lenk.

Further development of the method rests on Forssell's fundamental physiological studies concerning the mucosa of the gastrointestinal tract, the first results of which were published in 1913. In 1923 a paper by Rendich of New York appeared in the AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY on the examination of the relief of the stomach. It remained practically unnoticed in his own country.

A great step forward was made by Berg. The merits of his contribution concern first the introduction of improvements in technique which enable one to make roentgenograms with just the projection, the degree of compression and filling which are thought best during roentgenoscopy. More essential perhaps than this technical device is the fact that Berg recognized the importance of an extensive study of the whole inner surface of the gastrointestinal tract as part of the routine daily work of the roentgenologist.

Since then other publications have rounded out this method, especially those of Berg's own school (Albrecht, Knothe, Pansdorf, Schatzki, and Velde) and those of Gutzeit and Chaoul. Other names to be

* Read at the Thirty-fifth Annual Meeting, American Roentgen Ray Society, Pittsburgh, Pa., Sept. 25–28, 1934.

mentioned in connection with the development of the relief method are those of Baensch, Hellmer, Attinger, Baastrup, and Dyes.

Recent papers in the American literature on this subject are those of Held and Goldbloom, Geyman, Peter, Ettinger and Davis, and particularly the different papers and the monograph by Cole and his collaborators.

The principle of the method lies in the demonstration of differences in the relief of the inner surface of the gastrointestinal tract by the use of a thin coating of contrast medium instead of merely studying the profile changes of the completely filled organ.

The best way of obtaining just the coating which one needs to demonstrate pathological changes varies in the different parts of the digestive tract. It is often advantageous to fill the organ more completely and then obtain the desired degree of coating by cautious and accurately applied pressure. It is obvious that palpation plays an important rôle in the examination of those parts of the gastrointestinal tract where it can be used.

The question of roentgenoscopy or films is partially answered by the preceding sentence; certainly no examination without roentgenoscopy. Roentgenoscopy is the basis of the method, and only he who does good screen work will use it with success. But we cannot do without the film. There is no doubt that the film is superior if the roentgenoscopic findings are doubtful, hence usually in small lesions. But even if roentgenoscopy shows a definite lesion the film is often valuable; first to show the exact borders of the lesions and second, in the differential diagnosis.

It is, however, necessary that the film show exactly what one desires to demonstrate. This condition is fulfilled by Berg's "aimed" pictures which may be taken with his frame. There are many other methods of obtaining the same end, but the principle is covered by the apparatus first used by Berg in 1923. These "aimed" pictures, though they are theoretically not necessary for the demonstration of the relief, are practically intimately connected therewith.

Since it is impossible to discuss in this paper the entire gastrointestinal tract with all its diseases, we have chosen three examples which show the principles of the method: (1) gastritis; (2) duodenal ulcer; (3) some phases of the relief diagnosis of lesions in the esophagus.

The roentgen diagnosis of gastritis is a characteristic example of the value of the method. After the clinical diagnosis of gastritis had nearly disappeared at the beginning of this century, after it had been regarded as poor medicine to make such a diagnosis, this diagnosis was reclaimed for the clinician by the combined work of the surgical pathologists (Konjetzny), the gastroscopists (Schindler, Gutzeit, Henning), and the roentgenologists. The whole problem of gastritis will not be discussed here, only the roentgenological signs will be briefly stated. The names of Rendich and Berg must be mentioned before others (Gutzeit, Konjetzny, Albrecht, Dyes, von Hecker and Prévôt, Kuckuck, Schatzki, Velde, Weltz, and Cole) for their description of the roentgenological signs of the disease.

The normal relief of the stomach is mentioned for comparison. It shows the well-known picture of the rugae of the anterior and posterior wall of the stomach which may be demonstrated as separated or superimposed on each other.

What are the changes in gastritis?

A. *Hypertrophic form of gastritis* (Fig. 1). In this type of gastritis we *may* find typical changes, characterized as follows: (1) thickening of the rugae, (2) increased height of the rugae, (3) increased rigidity of the rugae. The latter sign is seen during roentgenoscopy. It may be impossible to make the rugae disappear on manual palpation.

If these changes are found they usually involve the whole stomach or at least the whole body or the whole antrum. Some-

times, however, the changes are localized and one sees a circumscribed area with swollen rugae (Fig. 2). In these cases one may be led to think of malignant infiltration (Cole). One usually succeeds in demonstrating the typical enlarged rugae by turning the patient. In other cases the differential diagnosis may be extremely difficult. Lymphoblastoma and congenital giant rugae have also to be considered in differential diagnosis, and it must be emphasized that the appearance of large rugae alone is usually not sufficient to make a positive diagnosis of gastritis.

Gastritis is further characterized by increased gastric secretion as well as by small round areas of diminished density which are due to particles of mucosa ("Schummerung," Berg).

The mucous particles should not be misinterpreted as fine granules of the inner surface which are extremely common in the gastroscopic picture but seldom demonstrable by the roentgen ray (Berg, Gutzeit).

Fig. 1. Diffuse hypertrophic gastritis.

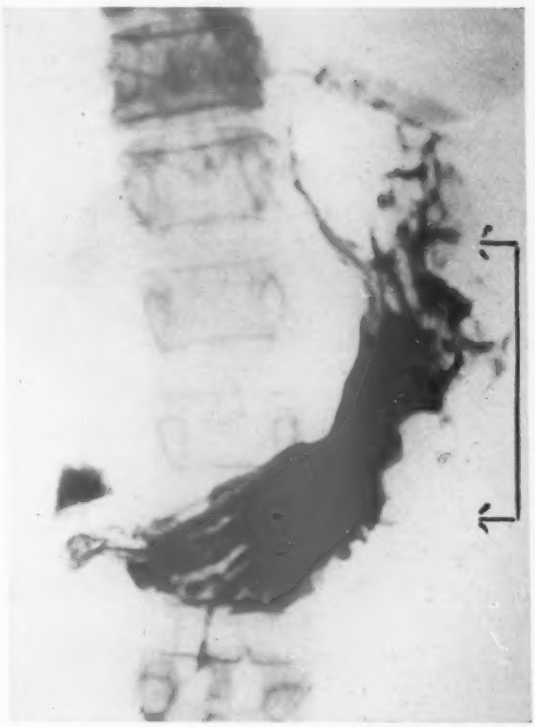

Fig. 2. Localized hypertrophic gastritis at the posterior wall of the body of the stomach near the greater curvature (arrows) confirmed by gastroscopy (Dr. Henning) and by follow-up.

Polypoid hypertrophic inflammatory changes are likewise extremely rare (von Hecker and Prévôt, Konjetzny, Kuckuck, Weltz).

B. *Atrophic form of gastritis.* It is not possible to diagnose the atrophic type by roentgen examination because normal cases may show thin rugae similar to those which we sometimes find in atrophy, and there may be normal rugae in cases with complete atrophy of the mucosa (Maley and Velde, Henning, Schatzki and Ornstein).

C. *Ulcerative erosive form of gastritis.* It was once thought that the third form of gastritis, ulcerative or erosive gastritis, could not be demonstrated by the roentgen ray. This type is characterized by very shallow superficial erosions. These stomachs usually show an extreme degree of secretion. A few years ago one of us (Schatzki) succeeded for the first time, after several futile attempts, in obtaining

roentgenograms of this condition. The diagnosis had been made by gastroscopy (Fig. 3). Roentgen examination showed multiple small ulcer flecks lying on the crests of the rugae. Each of them was surrounded by an edematous wall. The rugae appeared as if sprinkled with ulcers. Two months later, after medical treatment, the erosions had disappeared. They could not be found either by the roentgen ray or by gastroscopy.[40]

Fig. 3. Ulcerative, erosive gastritis. Spot film in the region of the angle of the stomach. The multiple circular areas of swelling around shallow ulcerations (flecks) in conformity with the gastroscopic picture of the case. The two horizontal lines correspond to margins of two vertebrae.

To Summarize the Roentgen Diagnosis of Gastritis. Gastritis may be present in cases with normal relief. Sometimes, however, a definite diagnosis of gastritis can be made by the roentgen ray. These cases represent an achievement of roentgenology. They can be diagnosed only by a study of the relief. On the other hand, the diagnosis ought not to be used indiscriminately in all those cases in which the roentgen findings are negative. The diagnosis should never be made by just one sign, for instance the width of the rugae, but should always be supported by several factors, namely, the width, height and rigidity of the rugae, kind of secretion, amount of mucous, and not forgetting the experience and self-criticism of the examiner.

The next subject which we will discuss concerns a disease, the diagnosis of which is especially suitable for the combination of the relief method and Berg's technique of taking instantaneous roentgenograms with localized pressure under roentgenoscopic control, i.e., *ulcer of the duodenum.* The development of the roentgen diagnosis of this disease is marked by the names of Haudek, Cole, George and Gerber. Their work has established the roentgen signs, particularly the direct signs of duodenal ulcer. The exactness with which this diagnosis can be made today is due to the further contributions of Åkerlund and Berg. Berg's "aimed" pictures represent the climax of a long development.

Roentgenograms taken with his method show marked conformity to the anatomical specimen. Stress is laid upon the demonstration of the niche itself. This niche is shown as far as possible in two projections: in relief and in profile (Fig. 4).

There is no doubt that one may recognize the presence of a deformed cap in most of the cases during roentgenoscopy. Why then roentgenograms, and why roentgenograms taken with this special technique?

1. These roentgenograms are of importance when there are technical difficulties during roentgenoscopy, for instance, if the filling and emptying of the cap occur so rapidly that there is not time enough to study the cap satisfactorily. In this same group belongs the examination of very stout patients.

2. The pathological changes may be so small that they are not seen during roentgenoscopy, or remain doubtful.

3. An absolutely normal relief of a cap which also shows no gross deformity allows one to exclude an ulcer. This conclusion can, however, only be drawn from a picture of the relief as small lesions may be missed by roentgenoscopy.

4. The roentgenograms taken with this technique permit the detection of more

niches than one may see during roentgenoscopy or obtain in roentgenograms taken without roentgenoscopic control of filling and compression. The niche, however, is the most conclusive ulcer sign and the only one which proves activity. If one

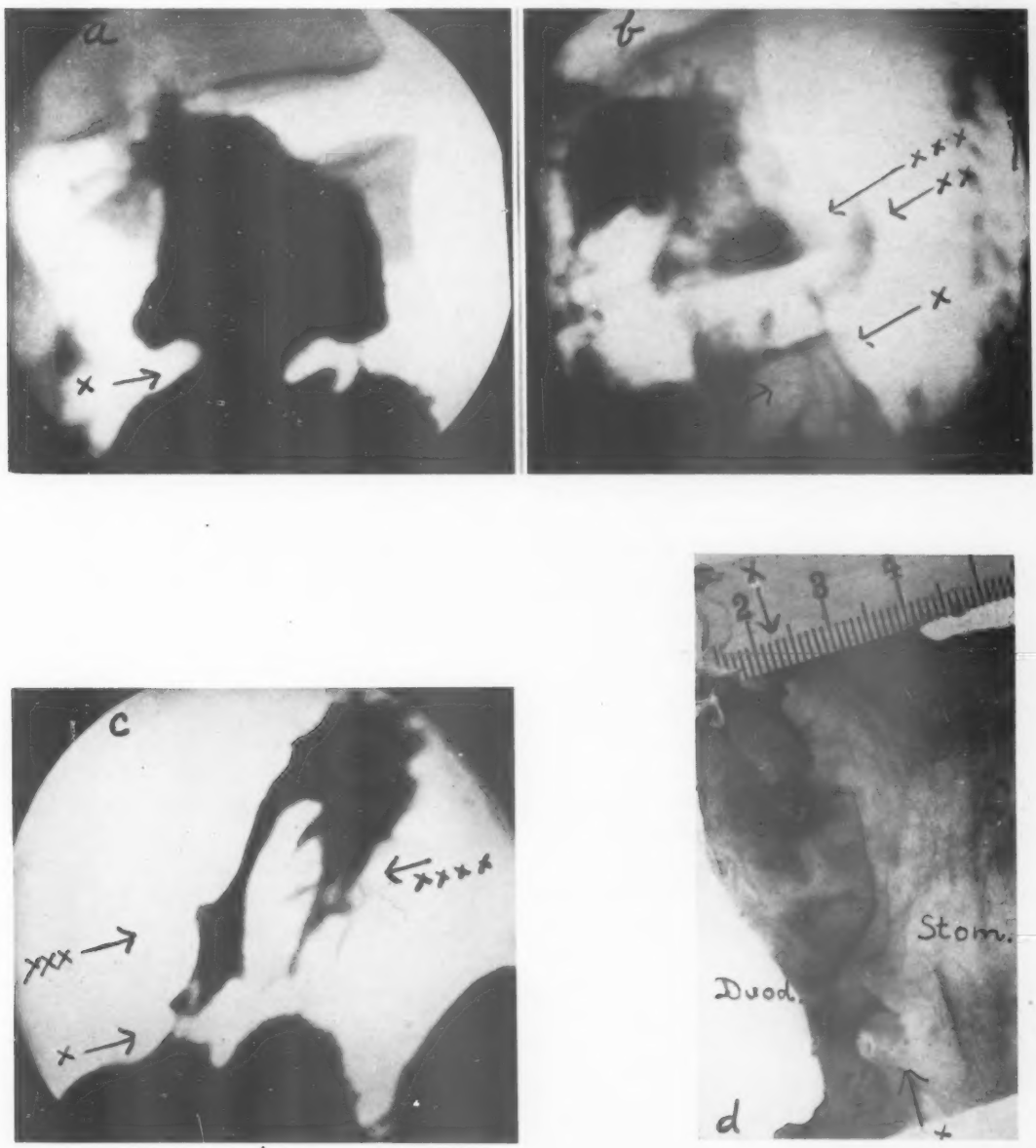

Fig. 4. Active ulcer on the anterior wall of the duodenal cap. History of two years. Spot films over prepyloric region and cap. *a*. Complete filling shows normal cap (*x*, pylorus). *b*. Film taken in same position as *a* but with compression showing large ulcer crater in the center of the cap. Note halo around the ulcer corresponding to circular swelling, slight convergence of the rugae towards the ulcer (*x*, pylorus; *xx*, margin of compressed cap; *xxx*, ulcer). *c*. Film taken in the left oblique view showing ulcer in profile as a shallow projection on anterior wall of the cap; projection only seen in this special angle. The surrounding biconcave margin of the cap indicates the circular swelling (*x*, pylorus; *xxx*, ulcer; *xxxx*, descending duodenum). *d*. Fresh surgical specimen of the case opened near the greater curvature. Anterior wall forms the upper part, posterior wall forms the lower part of the picture. Ulcer crater with surrounding swelling seen in the upper part of duodenal side of the specimen (*x*, pylorus, running vertically through the picture).

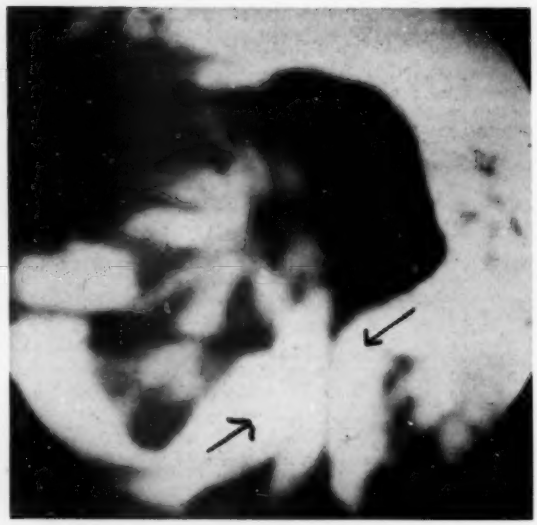

Fig. 5. Spot film of the duodenal cap with niche in its center. Star formation of the rugae towards the ulcer. Only slight deformity of the outlines of the cap (arrows indicate region of pylorus).

finds a deformed cap without demonstrating a niche one only knows that this patient once had an ulcer. The ulcer may, however, have been healed for years. Only when we find the niche are we entitled to state that the ulcer is active. Even in cases showing marked cicatricial changes, the niche may be found frequently.

It is impossible to decide in many of such cases by roentgenoscopy alone whether there is a niche or not.

Activity is not excluded if one does not succeed in finding a niche, but if one succeeds, activity is proved.

5. The fixation of the findings on films is important for the study of the ulcers during treatment.

As the ulcer may still be present though the clinical symptoms have disappeared, it seems necessary to control the treatment by repeated roentgen examination. The treatment should in principle not be stopped until the niche has disappeared.

In summary, it can be said that by the Åkerlund-Berg technique one shows more, particularly more detail than by roentgenoscopy alone, and shows it better and with a greater regularity than with the usual films. It may be added that the examination is not markedly lengthened by taking these roentgenograms.

The inner relief of the esophagus will be discussed somewhat more extensively, as it has only lately been completely studied by the relief method, also because it has been of special interest to one of us during the last four years.

It is more difficult to obtain a thin coating of the inner surface of the esophagus than of other parts of the digestive tract, as the esophagus is not accessible to manual palpation. Technical details will not be discussed, but it may be stated that it is possible to obtain a relief of the esophagus in almost every case.

If such a coating has been obtained, one sees several thin parallel lines instead of the usual broad band-like shadow of the filled organ. The rugae are quite typical, and can be demonstrated in nearly every case. The normal relief is so typical that pathological conditions are rather easily recognized.

Broadening of the rugae indicates inflammation of the mucosa.

Esophagitis is rather often associated with other lesions of the esophagus, par-

Fig. 6. Shallow ulcer at the lower end of the esophagus (arrow), just above the diaphragm. Swollen rugae of the esophagus above the ulcer indicating inflammation. Ulcer and esophagitis confirmed by esophagoscopy (Dr. Henning).

ticularly with ulcers. It therefore may serve as a lead for the diagnosis of this lesion as shown in the examination of one of our patients who complained of pain behind the xiphoid immediately after swallowing. Nothing was found roentgenologically or clinically to explain this pain. The man was thought to be a psychoneurotic. The pain, however, remained constant. Re-examination showed marked thickening of the rugae of the esophagus; after having sought for a long time we found a flat, small ulcer just above the diaphragm, probably causing the inflammation (Fig. 6).

As it is not possible to discuss in this paper all lesions of the esophagus, diverticula and cancer will be omitted. Perhaps the most important part of the relief diagnosis of the esophagus concerns the diagnosis of varices. A definite diagnosis of these enlarged vessels is not possible without the relief method.

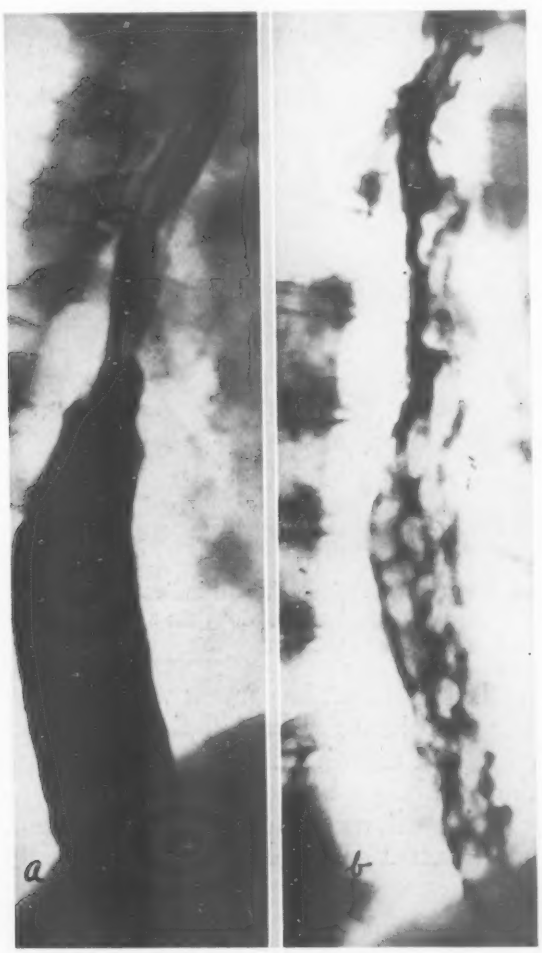

Fig. 7 Extensive varicosis of the esophagus in a case of cirrhosis of the liver confirmed by autopsy. *a*. Complete filling shows the dilatation of the esophagus. *b*. Relief picture.

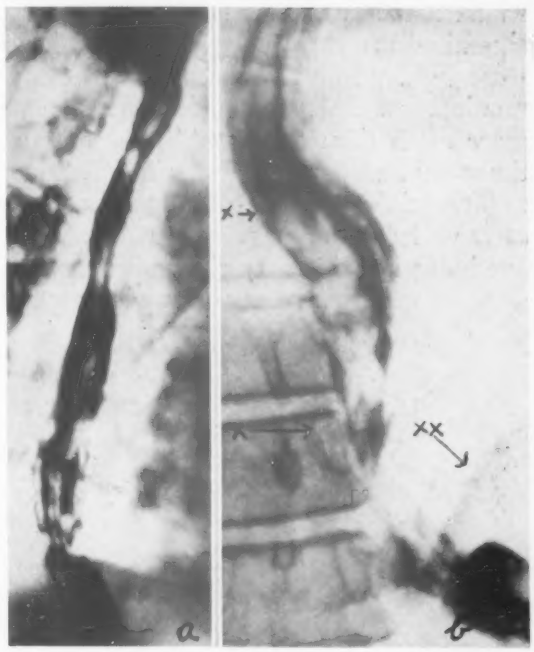

Fig. 8. Localized varicosis of the lower end of the esophagus. *a*. Relief picture taken in the right oblique view showing only little change from the normal relief. *b*. Relief of the same case taken in the anteroposterior view. (Lower end of the esophagus, more magnified than *a*.) Film shows a large tortuous vessel (varix demonstrated from *x* to *x*; *xx*, diaphragm).

The technique for demonstrating these varices is quite new. Wolf, in 1928, was the first to describe 2 cases with roentgenological signs of varices. Hellmer showed another case to the Swedish Roentgen Society in 1929. In 1930 Berg demonstrated a case, published in his monograph; in the same year one of us (Schatzki) reported 5 additional cases and also showed varices in the stomach. Since then several cases have been published (Hjelm, Albrecht, Beutel, Kirklin and Moersch, Israelski and Simchowitz, Brdiczka and Tschakert and Baumeister), but there are probably no more than 20 cases in the

whole literature other than our own. We should add to these the cases of which Dr. Ross Golden informed us in a recent communication. This diagnosis can be made more often than one would imagine from the small number of cases reported. One of us (Schatzki[52]) demonstrated roentgenologically no less than 45 cases within two and one-half years. Twenty-eight of these cases were proved by autopsy or esophagoscopy. Within the last year we have seen 13 more cases so that our experience is based on 58 cases.

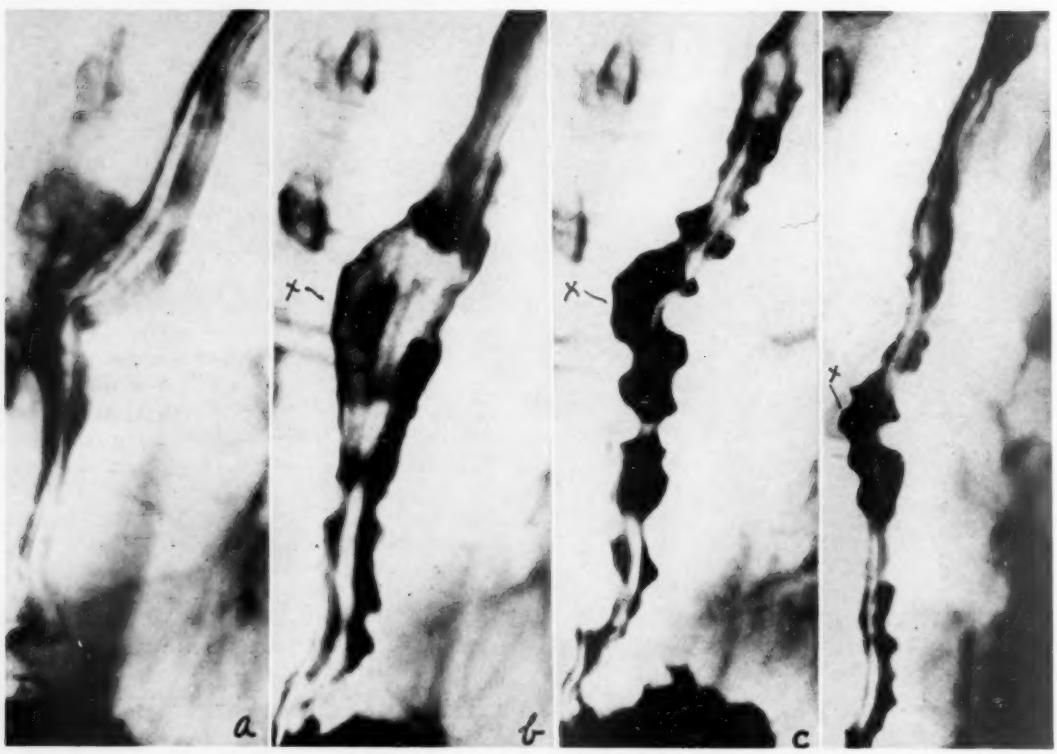

Fig. 9. Typical picture of a case of "curling," no varices. Region of definite adhesion indicated by arrow. *a*. Smooth margin of the esophagus. *b*, *c*, *d*. Same case now showing irregularities along the margins typical of "curling," and probably due to multiple adhesions. (Taken from Schatzki[52]).

Roentgen Findings. Only slight changes from the normal are seen if the complete filling of the esophagus is used. One may find indentation of the margins of the organ due to varices lying at the edge of the contour line. These changes are not pathognomonic for varicosis and a diagnosis should not be based on these findings. Very characteristic, however, are the changes seen in the relief picture. The pattern of the mucosa is completely destroyed. Instead of the normal thin rugae one sees a picture which seems to be quite irregular and which might be caused by a carcinoma. The exact analysis shows that there are tortuous net-like bands of decreased density. They are due to the enlarged vessels which protrude into the lumen and are projected above each other (Fig. 7).

One should not be content with this type of relief picture where all the vessels are lying in a disordered fashion. An attempt should always be made to represent an isolated enlarged vessel to a greater or lesser extent (ordered picture); the result will nearly always be successful if the patient is turned (Fig. 8).

Localization. Nearly all the cases which we have examined showed the varices immediately above the diaphragm, if there were varices at all. They extended very

often over the whole thoracic esophagus in contradiction to the common saying. In one case we could demonstrate varices even in the cervical part of the esophagus. The varices sometimes stop suddenly with the diaphragm. They may, however, extend into the stomach (2 of our cases), and may even be present only in the stomach (1 of our cases).

Width of the Esophagus. The abnormal widening of the esophagus in many cases with varices is striking (Fig. 7). This phenomenon is rather typical of extensive varicosis. The pictures remind one of idiopathic dilatation of the esophagus. The large diameter of the organ is to be explained by the mass of vessels lying in its lumen.

Narrowing of the esophagus rarely occurs. We have seen only one case with narrowing in the upper third of the thoracic esophagus and 2 cases with marked delay of the barium at the diaphragm, due to varicosis. Even in these cases there were no clinical symptoms of obstruction.

The picture of extensive varicosis is so characteristic that there is no difficulty in recognizing it for anyone who has seen it. The diagnosis is much more difficult if the varices are small. In these cases the mucosa must be examined in all directions very carefully (Fig. 8).

These cases are not easy to diagnose, but it is just these cases that are important, as they may represent early stages of cirrhosis of the liver.

Differential Diagnosis. Isolated varices may be mistaken for air bubbles. Reexamination protects against such an error.

Multiple adhesions, "curling," as one may call this appearance, of the esophagus can be misleading (Fig. 9). The relief picture makes the differential diagnosis easy.

The most important part of the differential diagnosis is in regard to cancer. If the varices are very extensive, only an untrained examiner would make this mistake. But there may be difficulty in excluding cancer in cases of isolated varicosis. One therefore needs signs to distinguish one from the other.

The esophagus maintains its normal elasticity even in extensive varicosis in contradistinction to cancer, and changes shape with respiration and with the action of the heart.

It is important to look for signs which are caused by the fact that the varices are blood vessels. We can show two of these attributes which are practically impossible in cancer: first, the varices can be pressed out by peristalsis, but cancer cannot; second, the size of the varices can be changed by changing the intrathoracic pressure; a simple way to do this is to have the patient attempt to take in and to expel the breath with closed glottis. These two tests are known in physiology as the experiments of Müller and Valsalva (Fig. 10).

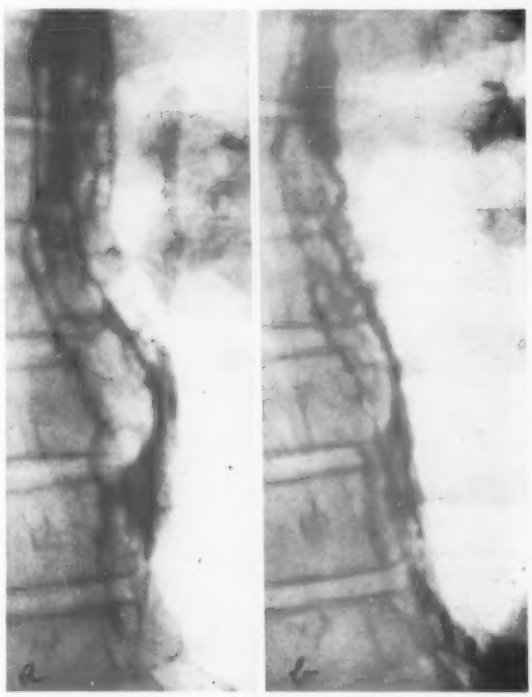

Fig. 10. Isolated enlarged varicose vein of the lower end of the esophagus showing changes in diameter during changing intrathoracic pressure. *a.* Broad vessel during experiment of Valsalva. *b.* Small vessel during experiment of Müller.

Etiology. In our cases, by far the greater part of all varices were due to cirrhosis of the liver of various types (including cases of Banti's disease). A few cases were due to

thrombosis of the splenic vein. In 2 cases we gained the impression that we were dealing with congenital varices in one, and the varices of old age in the other.

CONCLUSIONS

A few phases of the relief method have been chosen to demonstrate in a short survey its character. A discussion such as this necessarily places the findings of the relief method in the foreground, but we would like to emphasize that we can by no means omit the complete filling. We need it urgently to judge the elasticity of the organs, to study the relationship of the different parts of the digestive tract to adjacent organs and for many other reasons.

We hope that we have succeeded in showing that a method which tries to visualize the whole inner surface of the digestive tract with its lesions is an approach to the goal of all roentgen diagnosis: that is, to demonstrate as far as possible the anatomical findings.

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DISCUSSION

Dr. William H. Stewart, New York City. Dr. Schatzki has shown us so beautifully the value of the mucosal relief method in the diagnosis of gastrointestinal lesions. It is not new but the surprising part is that so few men in this country actually use it. In Europe it is quite routine.

The lack of proper apparatus seems to be

the leading reason why so many roentgenologists neglect this work. It is absolutely necessary to have a switchover. By this we mean a device whereby one can switch from fluoroscopy to roentgenography at an instant's notice. So few American manufacturers make such a device in their standard equipment; to my knowledge only one. Others will do so but the additional expense is almost prohibitive. There is also lacking any pressure device on the erect fluoroscopes. Look around when you pass through the commercial exhibit—you will not see one. At Zurich this past summer, during the session of the International Congress of Radiology every erect fluoroscope seen in the commercial exhibit had a Berg compression device attached. In fact, the fluoroscopes would not sell without this attachment. There are many makeshifts which hang on the screen, none of which are very satisfactory, mostly because they cannot be properly anchored. Some have small individual cassettes, others make four exposures on one 8″×10″ film. Personally, I prefer the small cassettes inasmuch as the exposure must vary with the rotation of the patient and varying exposures on one film render the dark room work difficult. As a matter of fact, the best apparatus is the one each roentgenologist is most successful with. The most ideal pressure device must be built into the fluoroscope. At any rate, if you desire to do this work equip yourself properly before you make any attempt.

Another objection to mucosal relief examinations is the amount of exposure the operator is subjected to. There is no question that considerable exposure is necessary. The roentgenologist should provide as much protection as possible. By this I mean the use of rubber gloves and aprons, lead glasses, etc.

In the matter of fear of increasing the expense of the gastrointestinal examinations, I may say that it costs very little more to make a few pressure films and the additional information obtained is well worth the difference in expense.

The next objection is the additional time that is consumed in making this special form of examination. It must be done in addition to the routine regular methods and therefore does consume a large amount of time. In fact, you must have a staff of considerable size to do this work and if your gastrointestinal service is heavy one man should devote himself almost entirely to this method.

We have been quite successful in differentiating large penetrating ulcers on the lesser curvature of the stomach from cancer with this mucosal relief method. Ulcers do not have the tendency to destroy the rugae the way cancer does and ulcers draw the rugae in by contraction causing deformity and enlargement of the lines. There is a "halo" around cancer that is seldom seen in ulcers. These, of course, are in addition to the usual roentgenographic signs.

In my institution there is very little call for roentgen examination in cases of suspected gastritis. Probably if we demonstrated our ability to diagnose this lesion more, the staff would take advantage of our services. In other words, up to the present time our experience with gastritis has been very limited.

The greatest satisfaction to be obtained in mucosal relief is in duodenal ulcer cases. Here, by this method, we are able not only to study the deformity of the bulb but the actual niche itself. The ability to demonstrate the ulcer crater and to watch its progress under treatment is indeed a great advancement. The work is not easy. It requires considerable skill. One of the greatest difficulties is in differentiating the niche from a fleck of barium retained between the contracted folds of the mucous membrane.

The work of Dr. Schatzki on the esophagus is noteworthy. His ability to use the mucosal relief method for demonstrating lesions, especially in the lower third, is brilliant. It is of great satisfaction to be able to show in certain obscure cases of hematemesis that the hemorrhage comes from varicosities at the lower end of the esophagus.

Dr. Ross Golden, New York City. I disagree with Dr. Stewart on one point with regard to the use of small films with single exposures on them. In my department, where the work has to go very fast, cutting the corners is absolutely necessary, and to handle four films instead of one in the dark room would make a very definite increase in the volume of work. I see no objection to making four pressure films on one 8″×10″.

I would like to say one word about the limitations of the method of compression studies of the duodenum. One of the worst diagnostic problems we have is a fat man who has had hemorrhage from the gastrointestinal tract. I usually am unable to find any reason for such a hemorrhage. His duodenum is usually tucked up under his costal margin and turned back.

It is extremely difficult to get pressure on that kind of a duodenum.

I am not exactly a fat man, but when Dr. Schatzki was kind enough to examine my duodenum, he found it impossible to approximate the anterior and posterior walls in spite of strong and rather uncomfortable pressure on my costal margin. That is a limitation in the use of this method which must be recognized. Åkerlund one time remarked to me that a duodenum did not interest him unless it appeared at first glance to be normal. I think we all should take that attitude and as soon as our manufacturers give us the kind of apparatus that we can use rapidly and efficiently, we will be making compression films with great satisfaction.

I would like to say one word about the technique of the examination of the esophagus, which Dr. Schatzki didn't take time to mention, and which I think he uses. The patient should be in the horizontal position, rotated one way or the other. Dr. Schatzki prefers to have the patient rotated to the right, and I prefer to have the patient rotated to the left. I demonstrated what I believed to be my first case of esophageal varices in 1929; we have had quite a number of cases since then and have invariably examined them supine, rotated toward the left. The patient takes three or four swallows of barium and the first exposure is made as the fourth swallow goes down. Two more films are made as rapidly as the cassettes can be changed to get the relief contours as the esophagus empties. We are not able to take films on our fluoroscopic tables rapidly, so we have to do it on an ordinary diagnostic table and try to make the films in a tenth of a second or less.

Dr. Schatzki (closing). Dr. Stewart asked about the differential diagnosis between ulcer of the stomach and cancer. That is a very important subject. I did not concern myself in this paper with the diagnosis of either ulcer or cancer of the stomach. There is no doubt that the relief method is of the utmost importance for the diagnosis and differential diagnosis of these lesions because the relief picture corresponds so closely to the anatomical appearance of the lesion. We should try to state what the pathologist will see when he has the opened specimen in front of him. But there are limits to any macroscopic diagnosis; e.g., frequently in the prepyloric region an ulcer looks absolutely benign when examined by the relief method or any other method, it looks absolutely benign when the surgeon opens the abdomen, and still looks benign when it comes into the hands of the pathologist, but does not look benign when he has the slide. It is of course impossible in such a case to make a diagnosis of cancer by the roentgen ray. One must state that the lesion has the macroscopic appearance of an ulcer, but may add a note, based on clinical experience, saying that ulcers of that region are apt to undergo malignant change as shown by Dr. Holmes and Dr. Hampton.

I should like to mention at this time that Dr. Golden has informed me that he has been able to demonstrate varices in several cases.

The demonstration of the relief of the esophagus in varices is usually much easier than it is in the normal esophagus. Examination of the relief is made by getting a thin coating after the main swallow has passed through the organ, the patient lying down. It is always better to do all these examinations with the patient lying down, or on an inclined table, which I personally think is the best way. If you have a quick switch with a possibility of taking films without any loss of time during fluoroscopy you take your films just at the moment in which the coating is optimal in regard to the demonstration of the lesion. If you do not have such an opportunity you may count the seconds that elapse between the swallowing act and the time that varices are best demonstrated, and reproduce the same conditions when making the roentgenogram.

AN EXPERIMENT ON THE EFFECT OF EXERCISE ON THE HEART IN ATHLETES

By RALSTON PATERSON, F.R.C.S., D.M.R.E.
and
EDITH PATERSON, M.R.C.P.
LATELY OF TORONTO

IT HAS been shown by Gordon[1] and others that a decrease in the size of the heart takes place after strenuous exercise. These observers estimated the heart size both in human subjects and rabbits from measurements of the transverse diameter of the heart as seen in a roentgenogram.

The observations we wish to record were made in order to extend these findings and to correlate the changes with any other factors which might be significant. It was thought possible that the decreased size of the heart as assessed by studies of the anteroposterior view of the heart might be more apparent than real and that if this were the case, measurements of the lateral aspect of the heart might possibly show no decrease, but even an increase in size due to distention of auricles and great veins. It was felt, too, that any change in heart size might be correlated with changes in heart rate and, further, that conclusions might be drawn between such changes in the size and rate of the heart and the ability of the subjects to stand physical exertion.

CONDITIONS OF EXPERIMENT

The necessary opportunity for this work was provided by a Walking Marathon Race which took place in Toronto on a hot day in June, 1930, the distance covered to complete the race being 31 miles. The time taken to walk this varied from five hours eight minutes to seven hours forty-three minutes. The observations recorded are mainly of 10 individuals who completed the race. We have, however, included for comparison the roentgen measurements of 3 others who abandoned the race after walking varying distances, and who were conveyed to our examining room considerably rested.

THE TECHNIQUE USED

The men, whose ages ranged between eighteen and forty-one years, were examined physically before and after the race. No points of significance were elicited in their histories, or in the clinical examination before the race. The apex beat was palpable inside the nipple line in every case. After the race, except in the case of 4 subjects who were in a collapsed state and whose apex beat could not be distinguished, the apex was felt to be situated well inside the nipple line and obviously nearer the midline than on the first examination. The roentgenograms were taken before the race and immediately after each athlete completed the race (that is, within ten minutes), the subject frequently being supported while the film was being made. A portable Victor roentgen-ray machine was used, and a two-second exposure was made which therefore covered both phases of the cardiac cycle. Both the anteroposterior and the lateral views were made at 2 meters. In the latter, in order to get a clear outline of the posterior edge of the heart, the exposure was made while the subject swallowed a barium mixture; this technique has been shown by Kovacz and Stoerk[2] and subsequent workers, to give a good view of the posterior edge of the heart by visualizing the cardiac encroachment on the esophagus. The heart sizes given are the measurements in square centimeters of the areas of the heart shadows both in the anteroposterior and the lateral position. This was done by means of a planimeter.

Electrocardiograms were made before

[1] Gordon, B. Effect of effort on the size of the heart. Am. J. Roentgenol. & Rad. Therapy, 1925, *14*, 424–426.

[2] Kovacz and Stoerk, O. *Wien. klin. Wchnschr.*, 1910, *23*, 147.

TABLE I

TABLE SHOWING CHANGE IN HEART SIZE AND RATE IN THOSE SUBJECTS WHO COMPLETED RACE

Athletes No.	Time taken to complete race hr.	min.	Anteroposterior measurements in sq. cm.			Lateral measurements in sq. cm.			Mean per-percentage diminution for antero-posterior and lateral views	Heart rates per minute		
			Size before	Size after	Percentage diminution	Size before	Size after	Percentage diminution		Rate before	Rate after	Percentage increase in heart rate
3 (Winner)	5	08	144.7	111.4	23.0	124.0	104.4	16	19.5	87.7	105.0	20
20	5	45	165.5	120.5	27.0	114.6	97.0	15.4	21.2	61.2	78.1	28
6	5	46	137.4	123.3	10.0	114.5	92.0	19.5	15.0	73.1	125.0	44
2	5	55	127.0	106.0	16.5	111.9	107.0	4.5	10.5	90.0	114.0	26
25	5	58	137.3	117.0	15.0	109.7	92.8	15.5	15.25	73.0	107.0	46
4	6	12	130.3	91.0	30.0	104.0	91.6	12.0	21.0	105.6	122.9	16
5	6	21	110.9	98.5	11.0	103.5	87.8	15.0	13.0	68.8	87.0	28
33	6	33	115.3	111.0	3.5	95.0	88.6	7.0	5.25	83.3	104.0	25
15	7	10	150.0	134.5	10.3	115.0	108.0	6.5	8.4	72.3	107.0	48
7	7	43	115.0	80.5	30.0	87.6	73.6	16.0	23.0	84.3	112.0	33

Averages, percentage diminution, Anteroposterior = 17.5 per cent, Lateral = 12.7 per cent, Mean = 15.1 per cent.

TABLE II

TABLE SHOWING HEART SIZES IN SUBJECTS WHO DID NOT COMPLETE THE RACE

Athletes No.	Number of miles completed	Anteroposterior measurements in sq. cm.			Lateral measurements in sq. cm.			Mean per-centage diminution for antero-posterior and lateral views	Heart rates per minute		
		Size before	Size after	Percentage diminution	Size before	Size after	Percentage diminution		Rate before	Rate after	Percentage increase in heart rate
34	15	119	103.0	13.4	103.6	76.6	25	19.2	100	102.0	2
30	15	122	102.4	16.4	94.0	87.3	17	16.5	112	92.6	decreased
13	10	137	127.4	7.0	100.0	91.0	9	8.0	85	79.0	decreased

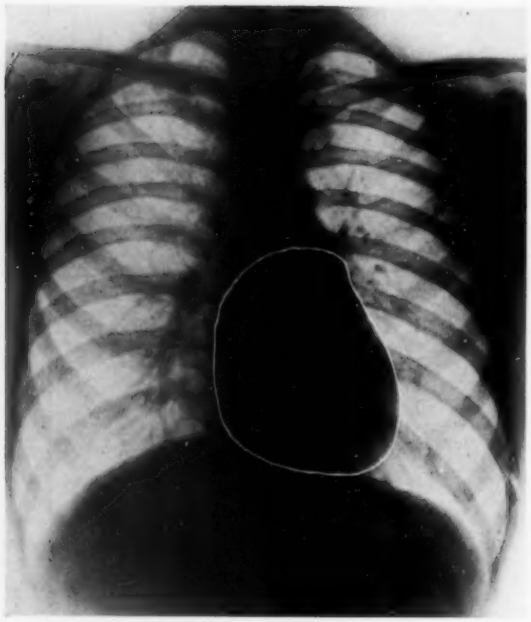

Fig. 1*a*. Athlete No. 7. Anteroposterior view. Before the race.

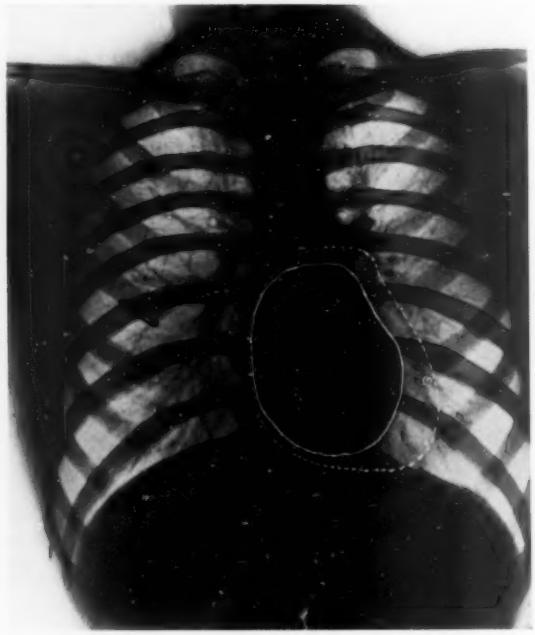

Fig. 1*b*. Athlete No. 7. Anteroposterior view. After the race. Dotted outline obtained by superimposing films of Figures 1*a* and 1*b*.

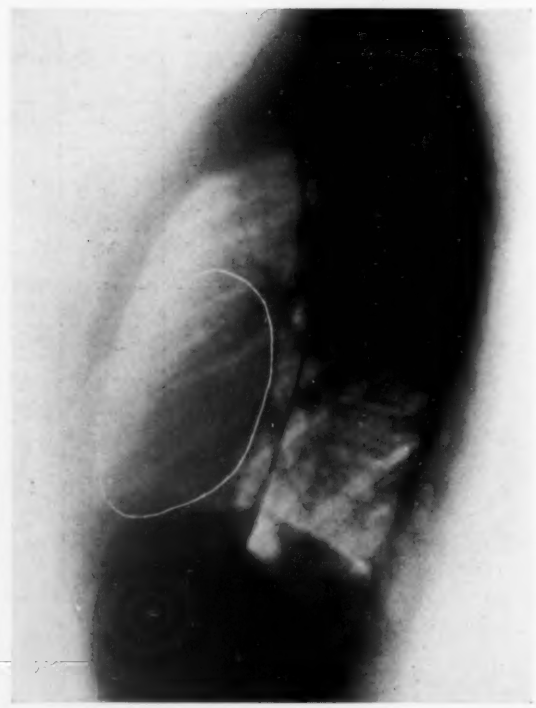

Fig. 2*a*. Athlete No. 7. Lateral view. Before the race.

Fig. 2*b*. Athlete No. 7. Lateral view. After the race. Dotted outline obtained by superimposing films of Figures 2*a* and 2*b*.

Fig. 3*a*. Athlete No. 3. Anteroposterior view. Before the race.

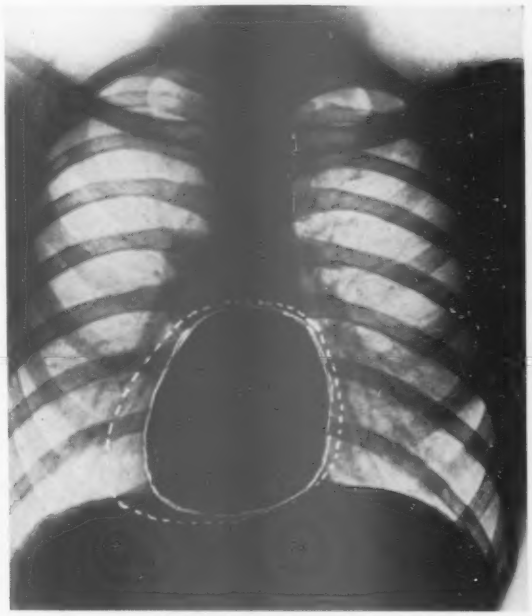

Fig. 3*b*. Athlete No. 3. Anteroposterior view. After the race. Dotted outline obtained by superimposing films of Figures 3*a* and 3*b*.

the race, immediately after the final roentgenogram, and a third tracing was made approximately two hours after the second. For this, a Victor portable electrocardiograph machine was used.

Fig. 4*a*. Athlete No. 3. Lateral view. Before the race.

Fig. 4*b*. Athlete No. 3. Lateral view. After the race. Dotted outline obtained by superimposing films of Figures 4*a* and 4*b*.*

* In the reductions, the lateral views do not show clearly. In the original films it was easily possible to outline the lateral aspect of the heart from the following points: (*a*) the posterior border of heart as outlined by the esophagus; (*b*) the upper outline of the heart at its junction with the sternum; (*c*) the antero-inferior reflection of the heart between sternum and diaphragm.

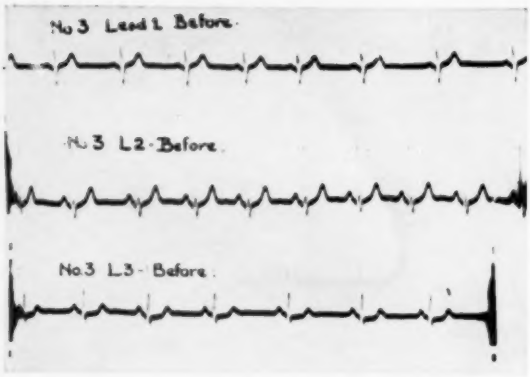

Fig. 5. Electrocardiograph tracings of Athlete No. 3. Made before the race.

ROENTGEN FINDINGS

Table 1 gives an analysis of the heart measurements in all those subjects who completed the race. Recorded separately (Table II) are the measurements made on subjects who abandoned the race. It will be seen from Table 1 that in every case a considerable diminution in the heart area had occurred in both views. The diminution is greatest in the anteroposterior aspects, where the decrease in cardiac area averages 17.5 per cent as against 12.7 per cent, the decrease in the lateral area. The athletes were designated by numbers and the arrangement in the table is that of the order of arrival at the winning post. It will be seen that diminution in heart size varies greatly, and that the amount of diminution bears no relationship to the athletic ability of the subject, as judged by his performance. Figures 1 to 4 show the films taken in 2 of the cases and illustrate the obvious decrease in heart size.

THE ELECTROCARDIOGRAPHIC OBSERVATIONS

The heart rates of those who completed the race were increased considerably in all cases. This percentage increase will be found in Table 1. A third electrocardiogram was made in all but two of the subjects, two hours after the second. The heart rate in the majority of the subjects had returned to the normal level. In 3 cases, the last 3 men to complete the race, the rate was still elevated. No relationship could be traced between the decrease in the size of the heart and the gross increase, or the percentage increase in cardiac rate. This will be apparent from a comparison of the mean diminution in heart size with the increase of heart rates shown in Table 1. In Table II are given the heart rates in those subjects who did not complete the race and who had had varying periods of rest. It is interesting to note that, although the heart rate had reached the previous level, or was even lowered, yet in those 3 cases the heart had not regained its previous size.

Those cases showing a sinus arrhythmia before the race showed with one exception a regular rhythm afterwards. In one further case showing an occasional ventricular ectopic beat before the race, a bigeminy was observed afterwards. The P.R. and the Q.R.S. intervals were unchanged in the majority of cases, but slight shortening of the P.R. interval occurred in 3 cases and of the Q.R.S. interval in 4 cases. The P wave was either increased in height or constant, and the T wave was increased in height in all the cases (except the case showing bigeminy). No constant changes were seen in the other deflections. A persistent right axis deviation was present in 2 cases, including the winner. Figures 5 and 6 show the tracings of Athlete No. 3 before and immediately after the race.

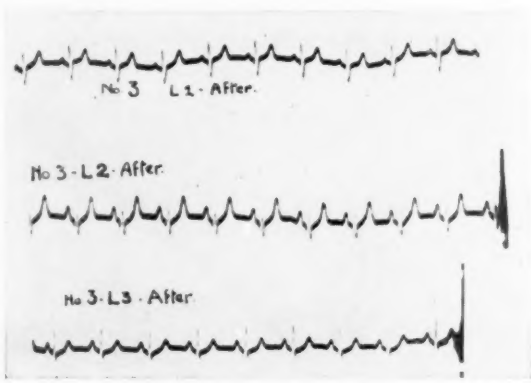

Fig. 6. Electrocardiograph tracings of Athlete No. 3. Made immediately after the race.

SUMMARY AND CONCLUSIONS

1. A Walking Marathon Race of 31 miles provided an opportunity for making various observations on the response of the heart to exercise.

2. From planimeter measurements of roentgenograms, it was found that the size of the heart decreased after severe exercise in all the subjects observed. This diminution was seen both in the anteroposterior and in the lateral views of the heart, and averaged 17.5 per cent in the former view of the heart, and 12.5 per cent in the latter. The maximum diminution observed was 30 per cent seen in two cases in the anteroposterior view.

3. This decrease bore no apparent relationship to the increased heart rate and it persisted after the heart rate had returned to normal. The diminution of heart size, therefore, is not comparable with that which has been shown to occur when the heart is accelerated without physical exertion.

4. The decrease in heart size could not be correlated with the athletic ability of the individuals.

5. No significant changes occurred in the electrocardiograms.

We wish to acknowledge our indebtedness to Dr. William Finlay, the trainer of the athletes, for his constant assistance; to the Manager of the Toronto Office of the Victor X-Ray Corporation who generously loaned the portable roentgen-ray and electrocardiographic apparatus; and to the athletes themselves.

THE ESOPHAGUS IN DISEASE OF THE HEART AND AORTA

CASE REPORT WITH ROENTGEN AND POST-MORTEM FINDINGS*

By J. B. SCHWEDEL, M.D., *and* E. B. GUTMAN, M.D.
NEW YORK CITY

THE rôle o the esophagus in the diagnosis of heart disease has been discussed in the anatomic studies of Stoerk[1] and in the roentgenographic studies of Holzknecht, Rösler and Weiss,[2] Rigler,[3] and others.

Normally, the esophagus lies in close relation to the vertebral column and is indented on its left side by the aortic arch, forming the so-called "aortic bed" of Kreuzfuchs.[4] Below this the esophagus lies in relation to the posterior surface of the left auricle proximal to its egress through the hiatus. The left auricle forms a long shallow depression on the esophagus which is accentuated when this chamber is enlarged.

In aortic disease, dilatation and elongation cause a lifting of the "aortic bed" and, in order to accommodate the lengthened thoracic aorta, displace the esophagus posteriorly and to the left. Visualization of the course of the esophagus by means of roentgenography is made possible by allowing the patient to swallow a medium thick barium mixture.

The following case demonstrates unusual displacement of the esophagus:

REPORT OF CASE

M. C., female, aged fifty-six, was admitted to the Medical Service of the Montefiore Hospital with a history of dyspnea, nocturnal and on exertion, of one and a half years' duration, and edema of the lower extremities followed by swelling of the abdomen for one year. At another hospital she lost weight (from 190 lb. to 135 lb.) on diuretics and rest, and was partially relieved of her symptoms. These again recurred prior to her admission here.

Examination revealed a middle-aged, dyspneic female, apparently chronically ill. The cervical veins were tortuous and distended and filled slowly from below. The heart was enlarged to the left anterior axillary line. A systolic murmur replacing the first sound was heard over the entire precordium. The second

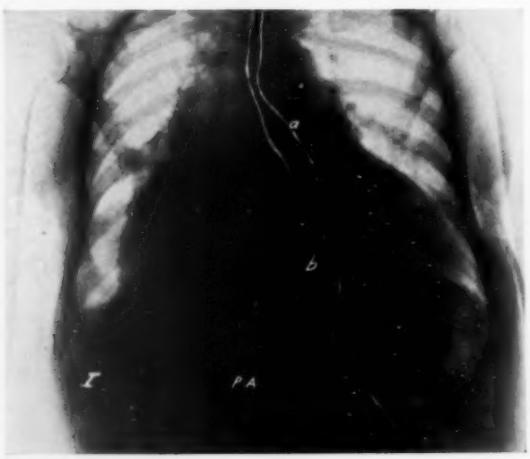

FIG. 1. Barium-filled esophagus, retouched, displaced to the left at, *a*, by aorta and, *b*, eccentric displacement farther to the left by the enlarged left auricle.

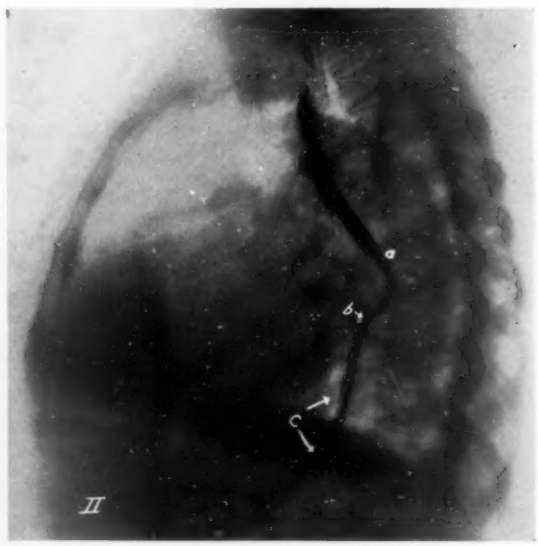

FIG. 2. Left anterior oblique position: *a*, aortic adhesion; *b*, left auricular adhesion, and *c*, posterior displacement by enlarged left auricle.

* From the Radiographic Department of the Montefiore Hospital, New York.

aortic sound was accentuated. No diastolic murmurs were heard. Blood pressure readings were 150/94 and 158/92. The heart rhythm was totally irregular. There were basilar crackling râles, the liver was enlarged to the level of the umbilicus, and edema of the abdominal wall and lower extremities was noted.

There was a moderate albuminuria, the blood Wassermann and Kahn reactions were 4 plus, and the spinal fluid examination was entirely negative. The electrocardiogram showed auricular fibrillation, left axis deviation, and evidence of intraventricular conduction disturbance.

The clinical diagnosis was hypertensive heart disease, cardiac enlargement, mitral insufficiency, relative tricuspid insufficiency; congestive heart failure, chronic passive congestion of the liver and lungs; dependent edema; syphilis.

Course. With rest, digitalis and salyrgan therapy, the patient rapidly lost weight, but dyspnea and distention of the neck veins persisted and she became increasingly distressed and emotional. She died suddenly one night.

Roentgen Findings. Roentgenography and roentgenoscopy of the heart on several occasions revealed pulsatile expansion and marked dilatation of the secondary branches of the pulmonic artery. There was marked enlargement of the left ventricle, marked enlargement of the inflow portion of the right ventricle, and moderate enlargement of the outflow portion.[6] The left auricle was seen as a centrally placed area of increased density within the cardiac shadow in the posteroanterior view, and in the right anterior oblique position bulged into the retrocardiac space. In the left anterior oblique position, enlargement of the left auricle caused an elevation of the left main bronchus. The right auricle showed marked enlargement, visualized best in the left anterior oblique position. The aorta showed marked fusiform dilatation and elongation of its ascending, arch, and descending portions.

Fig. 3. Posterior view of post-mortem heart: *a*, aortic adhesion; *b*, esophagus, and *c*, left auricle; *LL*, left lung; *RL*, right lung.

Fig. 4. Posterior view of plasticene model. Note displacement of esophagus to left (arrows): *a*, aorta; *b*, esophagus; *LA*, left auricle; *LV*, left ventricle; *RA*, right auricle.

The barium-filled esophagus was displaced to the left in the posteroanterior view and posteriorly in the left anterior oblique position, apparently because of its fixation to the adjacent posterior aorta. The lower segment of the esophagus was again displaced eccentrically posterior and to the left by the enlarged left auricle.

Pathological Findings. Post-mortem examination by Dr. Charles Spark revealed a markedly enlarged heart weighing 600 grams. There were numerous stringy adhesions from the pericardium to the left auricle and to the great

Fig. 5. Left oblique view of model. Note posterior displacement of esophagus by aorta and by the left ventricle: *a*, aorta; *PA*, pulmonary artery; *LA*, left auricle; *LA App.*, left auricular appendix, and *e* esophagus.

vessels at the base. The left ventricle was greatly enlarged, chiefly by dilatation. The mitral ring admitted 3 fingers and was calcified. Both auricles were greatly enlarged, the left more so than the right. The left auricle bulged backwards into the retrocardiac space and displaced the left bronchus upwards. Both auricular appendages were enlarged and both contained partially organized thrombi. The foramen ovale was patent and admitted one finger, but was partially covered by a fold which during life probably acted as a valve. The right ventricle showed enlargement both of its inflow portion (tricuspid orifice to apex) and of its outflow portion (apex to pulmonic ostium). The tricuspid orifice was not enlarged and admitted 3 fingers. The coronary vessels were atheromatous but patent throughout.

The ascending arch, and descending aorta were striking. There was considerable thickening, inelasticity, and dilatation. The aortic arch was elongated, and in situ the descending portion was palpated to the left of the vertebral column, lying in the costovertebral gutter. There were thin fibrous adhesions between the junction of the arch and descending aorta, and the esophagus (Fig. 3). These occurred at the level of the upper border of the left auricle.

The intima of the ascending arch showed irregular wrinkling and scarring, and throughout the rest of its course the aorta showed numerous atheromatous plaques with and without calcification. Microscopic study failed to reveal definite evidence of syphilitic aortitis.

The lungs showed chronic passive congestion and several recent and old infarcts.

DISCUSSION

In order to understand the peculiar tortuosity of the esophagus, a life-size plasticene (moulding clay) heart was constructed, modelled after the post-mortem specimen and conforming to the films with barium-filled esophagus taken during life.

There were three main deviations in the downward course of the esophagus. The first was posterior and led to the adhesions at the junction of the arch and descending portions of the aorta (Figs. 2 and 5). Just below was the second displacement of the

Fig. 6. Roentgenogram of model in posteroanterior view. Arrows show border of lower esophagus as it is displaced to the left.

esophagus by the adhesions to the upper portion of the left auricle (Figs. 2 and 5). Finally, the lowest impression was produced by the pressure of the enlarged left auricle on the esophagus, displacing it posteriorly and to the left (Figs. 1 and 4).

There was further confirmation of the eccentric displacement of the lower portion of the esophagus to the left by the enlarged left auricle. This was due to the wholly fortuitous circumstance that in the building of the model, the center was left hollow, and this decreased density allowed the greater density of the constructed esophagus to show through (Fig. 6).

SUMMARY

A case is presented of unusual displacement of the esophagus due to adhesions to the heart and aorta, with roentgenological and pathological studies.

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ACUTE INFLUENZA PNEUMONITIS*†

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HONOLULU, T. H.

DOES influenza present an unusual pulmonary complication in Hawaii? There is endemic in Hawaii, as elsewhere, a mild acute respiratory infection which is more prevalent some years than others, and which is familiarly referred to as "flu." Influenza appears here in three forms: the myalgic, distinguished by the predominance of eye and back pains; the form in which intestinal symptoms are outstanding, and the most common type which is characterized by upper respiratory symptoms. The first and last types are often combined. Both the respiratory and the myalgic forms of influenza have in the army shown pulmonary complications and it is with these that this report is concerned.

In the effort to control the spread of infectious disease in the army all soldiers in Hawaii are hospitalized who show a rise of temperature to 100° F., with the result that many cases of mild influenza are seen in the military hospitals, while only severe cases reach the civil hospitals. It is believed that early hospitalization and bed rest prevent serious complications, hasten convalescence and at the same time tend to abort local epidemics.

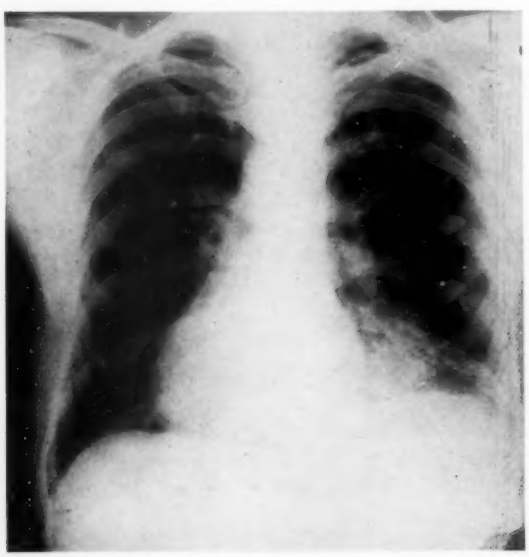

FIG. 1. Small area of pneumonitis in cardiohepatic angle.

A typical patient complains of headache, backache and malaise. He arrives at the hospital with temperature 100° F., pulse 90, and respiration 20. The only objective finding on examination is an injected pharynx. The patient is given calomel and acetylsalicylic acid and is generally much better by the next morning. In two or three days a certain number of cases develop cough with or without fever and no increase in respiratory rate. Examination shows a few râles and occasionally signs of slight consolidation. White blood count shows about 5,000 leucocytes with 60 per cent neutrophiles. Urine, blood pressure, sedimentation time are normal. Culture of carefully obtained lung sputum generally shows *Streptococcus viridans*, almost never pneumococci, or Pfeiffer's bacillus. Before all the laboratory reports are back the patient appears to have recovered and wants to leave the hospital. The roentgen laboratory, however, reports a small area of pneumonitis in the cardiohepatic angle (Fig. 1). The patient is held in the hospital until the roentgenologist reports resolution —usually in seven to ten days.

Routine roentgenographic chest examination of these mild influenza cases has revealed a very high incidence of this localized involvement which has been called "acute influenza pneumonitis." That this complication is not confined to the typical respiratory cases is shown by studying the primary diagnoses of the 30 cases of pneu-

* Read at the Annual Meeting of the Hawaii Territorial Medical Association, April 27, 1934.

† Published with the consent of the Surgeon General of the Army, who assumes no responsibility for any statements contained herein.

monitis seen in 1933. Half of the cases followed influenza characterized primarily by aches, pains, malaise and fever; while in the other half the trouble started as a definite respiratory infection, a nasopharyngitis and bronchitis.

During the last three years among the 15,000 white troops in Hawaii the following diseases were reported by the Department Surgeon:

Year	1931	1932	1933
Common respiratory diseases	2,263	1,698	1,750
Influenza	279	296	271
Secondary pneumonia (pneumonitis)	8	23	89
Lobar pneumonia	51	5	6

There has been a marked rise in the incidence, or observation, of secondary pneumonia during this period. Only one-third of the 1933 cases of pneumonitis were reported by Tripler General Hospital. The incidence of pneumonitis varies in different epidemics. In 1933 at the Station Hospital, Schofield Barracks, there were 200 cases diagnosed influenza and there were 60 cases of pneumonitis. In the Honolulu epidemic of February, 1934, there were 106 cases admitted to Tripler General Hospital and pneumonitis developed as a complication in only six.

No definite cause has been found to explain why pneumonitis should be so common in Hawaii. Some suggest that the constant brilliant sunshine reduces the virulence of the causative organism and that the pneumonias are abortive; others that the climate is debilitating, and that the ration does not provide sufficient alkali reserve for the tropics, thus making the patients less resistant to infection. Whatever the reason, from 5 to 25 per cent of influenza cases in the army hospitals develop a pneumonitis. There is probably some difference in the infecting organism in various epidemics, but until there is some criterion by which a positive diagnosis of influenza can be made there will continue to be confusion in distinguishing mild influenza from other acute respiratory diseases, and statistics will continue to be inaccurate. Neither the cause of influenza nor of the complicating pneumonitis is known.

As in other influenza epidemics the later cases are more serious. Toward the end of the 1934 epidemic the pulmonary complications showed a marked increase both in number and severity. These exhibited all grades of involvement from a mild pneumonitis, through bronchopneumonia involving a whole lobe, to the typical influenza pneumonia involving all lobes. Fortunately, there were no fatalities. This experience would seem to indicate that influenza pneumonitis is a mild or abortive influenza pneumonia.

As to the use of the word pneumonitis to describe this roentgen pathology, Karsner's text[1] states,

> Inflammations of the lungs are referred to as pneumonia or pneumonitis . . . Bronchopneumonia broadly is employed to cover all forms of pneumonia not suppurative and not lobar in character.

Used thus comprehensively, influenza pneumonitis is a bronchopneumonia; but it has features which make it a distinct clinical entity. It is similar in roentgen appearance to the exudative inflammation around a lung abscess, to the perifocal reaction in nodose tuberculosis, and to the exudative lesions of childhood tuberculosis, all of which are at times referred to as pneumonitis. Influenza pneumonitis may at times resemble all of these conditions and require differentiation.

There has been a very definite effort on the part of the students of pneumonia to put the classification on a scientific basis. Reimann[2] asserts:

> The terms lobar and lobular pneumonia are becoming obsolete and will be superseded by terms indicating the causative organism. It is already possible to diagnose several distinct entities. Other forms are being actively investigated and no doubt will soon be differentiated from the confused group heretofore regarded as bronchopneumonia.

This report is an effort to separate one rather definite type from the confusion of the bronchopneumonias. Considering the

serious implications of the term "influenza pneumonia" as generally understood, it was believed that another term should be used to designate the very mild inflammation of the lung occurring with or following benign influenza. Influenza pneumonitis seemed to be a suitable distinguishing appellation.

In the literature at hand very little has been found regarding this condition. It is apparently new and unknown to physicians recently transferred to Hawaii from the mainland and was not generally recognized by the physicians established here, nor by the local roentgenologists.

Probably the most exhaustive research in influenza and pneumonia was made by the army during the great epidemic. In the report entitled, "The Medical Department of the U. S. Army in the World War" two volumes are largely devoted to influenza. Volume IX is entitled "Communicable and Other Diseases" and Volume XII is devoted to "The Pathology of the Acute Respiratory Diseases." Both are filled with valuable information and descriptions but neither describes cases as mild as those found here. Five types of influenza pneumonia were differentiated according to the pathological anatomy found at autopsy.[3] (1) lobar pneumonia; (2) bronchopneumonia, a consolidation spreading outward from the bronchi a varying distance into the surrounding alveoli with the lung irregularly consolidated, and usually both lungs affected; (3) lobular pneumonia, where groups of lobules, occasionally single isolated lobules, were affected, being scattered through one or several lobes; (4) interstitial pneumonia was found of greatest intensity in the supporting tissue of the lung, usually with hemorrhagic exudate. Consolidation occurred if patients lived long enough; (5) peribronchiolar pneumonia, the typical reaction to the bacillus of influenza, was basicly an involvement of the bronchi at their termination in the respiratory bronchioles whence it extended to the alveoli, producing minute miliary nodules primarily hemorrhagic.

In the A. E. F. autopsies it was sometimes found that an older focus of central pneumonia existed near the hilus, from which there appeared to be an explosive fatal spread to large areas of lung tissue a short time before death. Was this central pneumonia similar to the present findings? These volumes are profusely and elaborately illustrated but disclose nothing corresponding to the findings in these pneumonitis cases.

Cecil[4] made an intensive study of pneumonias during the war and apparently refers to the type here reported:

> The pneumonic form of influenza is a mixed infection. Considered clinically, cases may range all the way from those of a mild bronchopneumonia with limited pulmonary involvement, from which there is prompt recovery in four or five days with defervescence by lysis or crisis, to rapidly fatal cases. In many cases the areas of pneumonia are isolated and deep seated so that the typical signs of consolidation do not appear until late if at all.

Here is the nearest approach to a description of influenza pneumonitis found in the literature available.

PATHOLOGY

There have been no deaths from pneumonitis in the army hospitals but in the pathological material at Queens Hospital, Honolulu, two lungs were found showing small areas of pneumonitis. These areas were firm to palpation not nodular. On section they were moist with serous and hemorrhagic exudate which was easily squeezed from the consolidated lung. No gross pus was seen. Histologic examination showed some cellular infiltration of the smallest bronchioles and of the alveolar walls. Many alveoli were filled with red cells, others with serum. Some alveoli had considerable numbers of mononuclear and epithelial cells but polynuclear cells were not numerous. In other words, sections showed an early exudative inflammatory process.

DIFFERENTIAL DIAGNOSIS

Acute influenza pneumonitis may be confused with acute bronchitis, broncho-

pneumonia, bronchiectasis, pulmonary abscess (Fig. 2), and tuberculosis. In the presence of an epidemic, whenever there is a pulmonary complication, pneumonitis should be thought of. Clinically the condition probably passes for an acute bronchitis but a roentgenogram will always show the presence of an exudative process. The symptoms are much milder and the signs less extensive than bronchopneumonia.

Bronchiectasis may, however, present very similar signs and symptoms and one must go carefully into the history. During an acute exacerbation chest films show areas of pneumonitis of exactly the same appearance as influenza pneumonitis.[5] Examination with lipiodol may be necessary to establish the diagnosis in some cases. In influenza pneumonitis there is comparatively little sputum and what there is does not contain pus or fetid material such as is found in abscess or bronchiectasis. At least one case of acute pneumonitis at Tripler General Hospital went on to lung abscess of the benign type.

Pneumonitis of the upper lobes often presents the appearance of an acute nodose

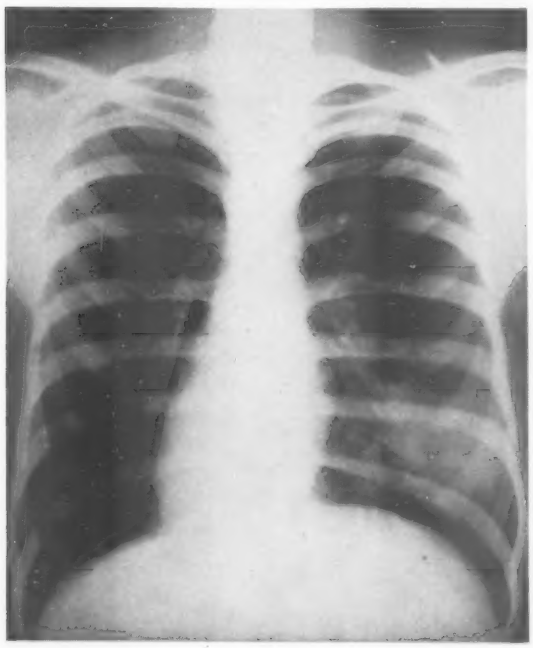

Fig. 2. Dense pneumonitis in right base resembling a lung abscess.

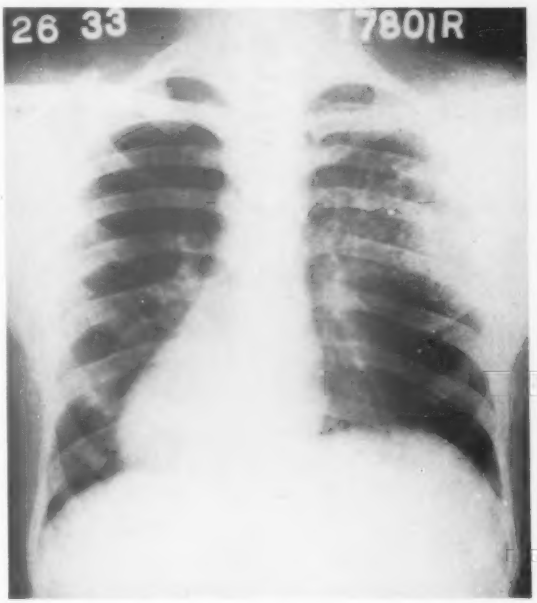

Fig. 3. Pneumonitis in right upper lobe confused with nodose tuberculosis.

tuberculosis in the roentgenogram, and such a case has been admitted to the local tuberculosis hospital (Fig. 3). The mistake is soon cleared up, however, for the sputum is always negative for tubercle bacilli and the rapidity of resolution belies the seriousness of the first impression. A series of films at short intervals will reveal the transitory nature of the process.

ROENTGENOLOGY

Influenza pneumonitis involves only a portion of a lobe, usually basal, though it has been seen in the upper lobes and involving more than one lobe without increase in symptoms. It extends outward from the hilus well into the parenchyma, occasionally reaching the periphery (Fig. 4). The roentgen appearance is that of a confluent mottled fan or rounded area, usually of homogeneous moderate density in the central portion, with the borders fading into the normal lung (Fig. 5). It has the appearance of an exudative alveolar infiltration and is usually more localized and of more even density than the bronchopneumonias of childhood or than those which complicate adult diseases. The usual

Fig. 4. Pneumonitis extending from hilus to periphery in right midlung.

picture of bronchopneumonia is a scattered mottling not confined to one lobe or sharply localized. Sante[6] gives an excellent roentgen description:

Bronchopneumonia is a pneumonic process characterized by multiple small areas of infil-

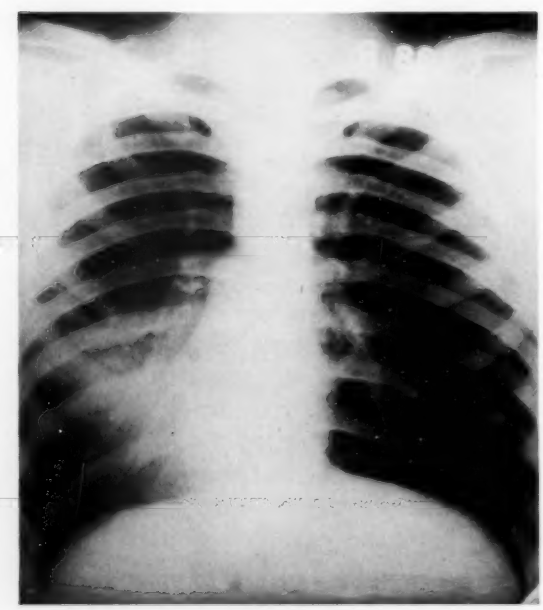

Fig. 5. Pneumonitis infiltrating from left hilus toward base and axilla.

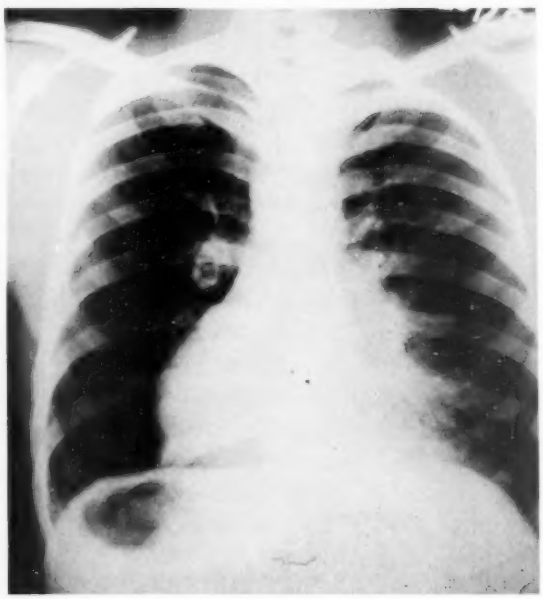

Fig. 6. Dense pneumonitis extending along cardiac border to right diaphragm.

tration clustering about the bronchi, the result of direct extension. Lesions are larger than tuberculous nodules, but not as large as metastases. They are soft in appearance showing feathery edges, and never appear discrete and clearcut. They coalesce to form irregular areas of consolidation. There is a pronounced increase in peribronchial markings.

In the Medical Department report previously referred to there is a section on "Roentgenology in Inflammatory Diseases of the Respiratory Tract."[7] A summary of that work is enlightening in this connection.

Systematic examination was found exceedingly valuable in throwing light on the nature of the early changes taking place in the lungs in uncomplicated influenza. Daily serial films were made of a large number of cases from admission to recovery or death. The X-ray evidence shows that some degree of pulmonary involvement is present in practically all cases of influenza, evidenced by a hazy opacity generalized throughout the lung, and a thickening of the bronchial structures and increased density of their shadows. This finding corresponds with the generalized hemorrhagic and edematous lesions of the bronchi and parenchyma described on postmortem examination of cases

dying early, and justifies the belief that substantially this condition in varying degrees exists in milder cases that recover without complication.

(None of the cases of influenza pneumonitis seen in Hawaii has had hemorrhagic sputum.)

At Fort Sam Houston twenty-five per cent of uncomplicated cases of average severity showed persistent rales at either base, with no other evidence clinicly of anything resembling pneumonia; however, x-ray films showed local areas of increased density corresponding to the physical signs. This finding is probably to be interpreted as an early or slight example of the lesions described from Walter Reed General Hospital as "hemorrhagic pneumonitis." This condition was correlated with the hemorrhagic infarctlike consolidations discovered postmortem. It showed on the films as a denser, smoky opacity obscuring the bronchial outlines, beginning at the hilus and extending peripherally. This shadow differs from the shadows of pneumonic consolidations both in distribution and in lesser density.

With secondary infection films show a great variety of pictures. The bronchopneumonic consolidations tend to begin near the hilus, to show first as a dense peribronchial thickening,

Fig. 7. Two foci of pneumonitis in left lung resembling metastases.

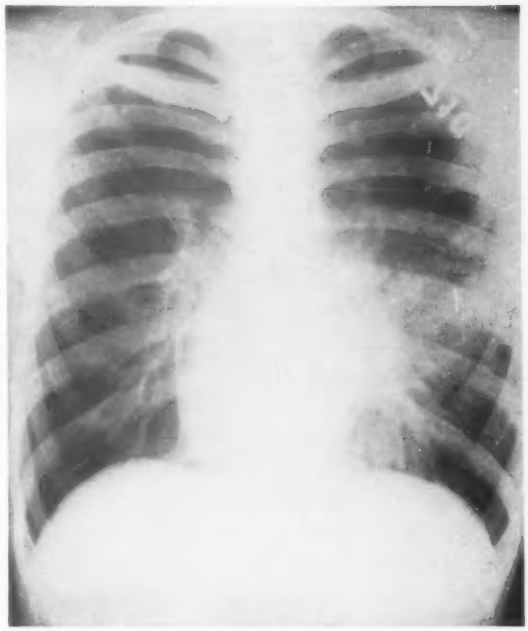

Fig. 8. Infiltration from right hilus suggesting malignancy.

with later nodular shadows grouped along the bronchi. Still greater extension results in confluence and the production of massive shadows resembling those of lobar pneumonia. True lobar consolidations show almost simultaneously throughout the area involved. The consolidations of the hemorrhagic type vary greatly from day to day and are correlated with the clinical picture. It appears that the radiographic evidence of resolution and recovery is more dependable than the clinical.

Only one journal reference was found. Eimer and Kastermann[8] describe a diffuse miliary infiltration of the greater part of both lungs seen on the roentgenogram of 2 fatal cases of influenza (peribronchiolar pneumonia). In 25 other cases in the same epidemic more or less definitely localized bronchopneumonic patches (pneumonitis) were seen in some portion of the lung and these cases all recovered.

Wessler and Jaches[9] have this to say:

The pneumonias which complicate influenza are characterized by an exudate which has great absorbtive powers for the Roentgen ray so that shadows of great density are produced. Further, the diversity of the pathological processes, comprising hemorrhagic, exudative and

purulent elements, scattered indiscriminately throughout the lungs, has been responsible for a multitude of Roentgen types which were previously not encountered.

Many of these cannot be distinguished from the lesions of tuberculosis in the films and must wait on clinical developments and subsequent films. Sometimes there is imperfect resorption and interstitial fibrosis which makes the diagnosis still more difficult. This led the Surgeon General after the war to order that no case should be diagnosed tuberculosis without a positive sputum. Continuing from Wessler and Jaches:[10]

One of the surprising disclosures of the Roentgen examination is the frequency with which unsuspected broncho-pneumonia at the bases is found in patients who are clinically regarded merely as cases of acute or chronic bronchitis. These pneumonias are commonly so mild and their physical signs are so completely obscured by those of bronchitis and emphysema, that they are overlooked and the symptoms are therefore regarded as an exacerbation of an existing bronchitis. The shadow of the pneumonia, usually in one of the lower lobes is of course readily perceived on the plate. Frequently the persistence of these pneumonic infiltrations is responsible for a chronic cough with expectoration which, in the absence of physical signs, is apt to put the patient under suspicion of tuberculosis; the Roentgenologist will here frequently have the grateful task of dispelling the fear of tuberculosis.

Since this mild pneumonitis was evidently reported during and after the war, it can hardly be claimed as a new disease, nor as one confined to Hawaii, although it appears to be much more common here than elsewhere. That it is not being recognized in recent epidemics, however, justifies this attempt to bring it again to the attention of the profession and to stress the necessity of roentgen examinations in pulmonary complications of even mild influenza.

CONCLUSIONS

(1) Systematic roentgen examination of mild influenza cases in Hawaii has revealed a high percentage of pneumonic complications.

(2) The term acute influenza pneumonitis is used to designate this benign complication.

(3) This report is made because, although the condition was recognized during the influenza pandemic, it appears to be largely unknown or forgotten, and its prevalence is not recognized unless routine roentgen examination is made in influenza cases with respiratory symptoms.

(4) A more scientific term indicating the clinical pathology is offered to supplant such loose phrases as, "a touch of pneumonia," "threatened with pneumonia," and "a spot in the lung."

Acknowledgment is made to the Medical Services of Tripler General Hospital, Station Hospital Schofield Barracks, Queens Hospital, and Leahi Hospital for assistance and cooperation in this study.

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Vol. 34, No. 2

INITIAL LOBAR TUBERCULOSIS*

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NEW YORK CITY

FROM its incipiency pulmonary tuberculosis assumes in some patients lobar proportions. In many, the disease is ushered in by symptoms and signs that are indistinguishable at first from those of lobar pneumonia. Although lacking the dyspnea and cyanosis, the symptoms are otherwise of such acute nature that the possibility of tuberculosis is not even considered, the patient being treated at home or in a general hospital for supposed pneumonia. When the pulmonary consolidation fails to resolve after a sufficient interval or when it shows evidences of undergoing ulceration, then other factors are sought to explain the condition. A sputum examination often reveals the tubercle bacillus but by this time the roentgenogram may fail to reveal the characteristics of the initial localization.

Some patients on closer questioning recall that for a variable length of time preceding the acute episode they had the "grippe" or "influenza" with slight cough, low grade fever, malaise and loss of weight. The acute onset or exacerbation of the disease was accompanied by high fever or chill or pain in the chest or hemorrhage and often by a combination of these symptoms. Less often the roentgen features of lobar consolidation are found in patients who present a paucity of symptoms, and these mainly catarrhal, whose time of onset is rather indefinite but of comparatively recent date. When the history is of long duration it is hazardous to assume that the tuberculous process was initially lobar in type. Indeed, we have seen several instances where serial roentgenograms revealed the lobar consolidation to be an intermediary stage or an end-result of an, at one time, extensive bilateral pulmonary tuberculosis.

The physical examination of patients with initial lobar tuberculosis may reveal few if any abnormal changes or else classical signs of pulmonary consolidation. The former is apt to be the case in patients with benign lobar tuberculosis; the latter in patients with malignant lobar tuberculosis. This is not invariably the case. The lesion localizes most often in the right upper lobe, occasionally in the left upper lobe and rarely in other lobes.

Roentgenologically, a characteristic picture is obtained. Occupying the entire or a major portion of the right upper lobe, there is noted an opacity, the lower border being more or less sharply delineated particularly in its outer half by the interlobar fissure. The latter is somewhat incurved with the convexity toward the apex. Quite often the fissure is displaced upward. In some films, due to its obliquity or distortion, infiltrations may appear to be present below the level of the fissure. A film taken in profile helps to demarcate the lesion more clearly. Depending on the stage of the disease the opacity may be homogeneous or it may present areas of variable densities. Usually the density is greatest in the region directly above the fissure, tapering off somewhat in the peripheral parts of the lobe, so that at certain stages of its evolution the apex may be fairly well illuminated.

COURSE OF THE DISEASE

The clinical course of initial lobar tuberculosis has been studied by Bernard,[1] Rist,[2] and their associates. In many respects it is analogous to the infraclavicular localization of pulmonary tuberculosis, a form of onset that has received much greater attention. Like the latter, the lobar infiltrate may absorb completely in a period of several months and leave practically no trace of its presence or, at most, fibrotic infiltrations or a thickened interlobar fissure. This is illustrated by the following instance:

* From the Tuberculosis Division of Montefiore Hospital, Dr. Harry Wessler, Chief of Division, and from the Medical Service of Morrisania City Hospital, Dr. Nathan B. Van Etten, Director of Medicine.

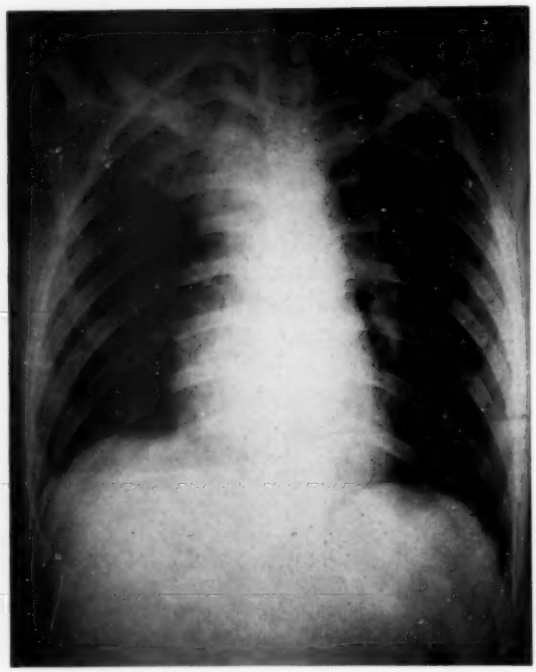

Fig. 1. Case 1. August 31, 1933. Lobar infiltration in the right upper lobe. Fibrotic infiltrations in left upper lobe. Sputum positive. Pneumothorax withheld.

Case 1. K. K., a girl, aged twenty-one, became ill one year previously with lassitude and digestive disturbances. She had no cough or expectoration. She was examined physically and roentgenoscopically at that time and was told that her lungs were clear. After a short vacation, she returned to her clerical occupation. On August 29, 1933, the day of her admission to Morrisania City Hospital, she began to cough up bloody sputum. The physical examination revealed impairment of the percussion note and harsh breath sounds with occasional râles over the right upper lobe. The sputum contained tubercle bacilli. A film taken two days later (Fig. 1) revealed a homogeneous density in the region of the right upper lobe and a few fibrotic infiltrations in the left upper lobe. Pneumothorax treatment was considered but in view of the absence of fever and her generally good condition it was decided to withhold collapse therapy and watch the disease further. Serial roentgen examinations in the following two months revealed a gradual resolution of the process and on October 5, 1933, the film revealed only faint infiltrations in both upper lobes (Fig. 2). She was transferred to a sanatorium. The last report is that her sputum is negative for tubercle bacilli and that she is doing well.

In other instances, after the acute stage of the disease subsides, the tuberculous process becomes partly fibrotic and partly caseous and assumes the course of chronic fibro-ulcerative pulmonary tuberculosis.

Case 11. M. R., a girl, aged nineteen, became ill July 5, 1929, with chill, fever and dyspnea. This was followed later by cough. A diagnosis of pneumonia of the right lung was made and she was treated at home for several weeks. Later, she was transferred to a city hospital where the diagnosis of lobar pneumonia was confirmed. She was removed to another institution where the roentgen film revealed an infiltration in the upper two-thirds of the right lung. The condition was considered to be an unresolved upper lobe pneumonia, probably tuberculous in nature. Tubercle bacilli in the sputum confirmed the diagnosis.

On admission to Montefiore Hospital, December 20, 1929, the physical and roentgen findings revealed a consolidation of the right upper lobe, particularly in its lower part, with

Fig. 2. Case 1. October 5, 1933. Almost complete resorption of the infiltrate. Patient is now in a sanatorium, sputum negative, doing well.

evidences of cavity formation (Fig. 3). The sputum was positive for tubercle bacilli. Artificial pneumothorax was successfully induced a week later and an excellent, selective collapse of the diseased lobe was obtained (Fig. 4). The pneumothorax was maintained for about one year and discontinued. She gained 15 lb. in weight and had few symptoms at the time she was discharged from the hospital. Subsequent films taken while she was attending the Tuberculosis Clinic of Montefiore Hospital revealed a gradual absorption of the pneumothorax and the most recent films show a fibrotic tuberculous process in the right upper lobe.

The lobar infiltrate may undergo early cavitation, and bilateralization may take place at any time in the course of the disease. When a single cavity forms, the area of lung affected is that immediately above the fissure. When, as occasionally happens, the disease in the remainder of the lobe clears simultaneously, the cavity appears in configuration and position not unlike the cavity which sometimes arises from an infraclavicular infiltrate.

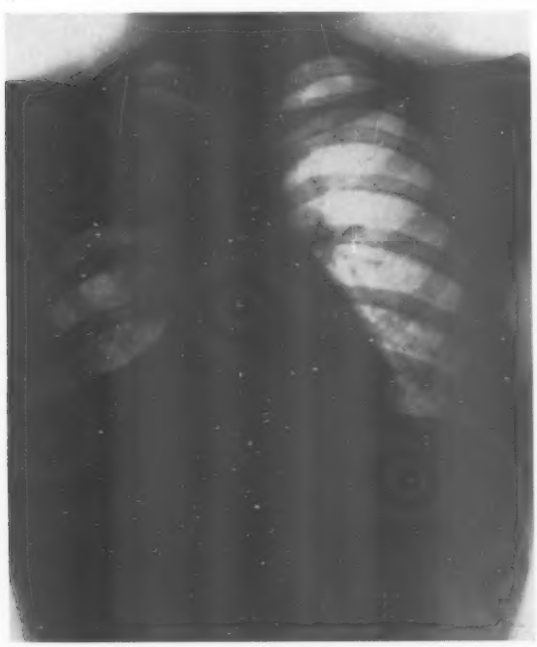

Fig. 3. Case II. December 21, 1929. Acute onset; treated for a time as a case of lobar pneumonia. Dense infiltration in right upper lobe, particularly in lower half, with clearly outlined interlobar fissure. Sputum positive.

Fig. 4. Case II. January 9, 1930. Two weeks following institution of artificial pneumothorax. The upper lobe shows a greater degree of collapse than the lower lobes. Pneumothorax discontinued after one year's treatment. At present, condition is that of fibro-ulcerative tuberculosis.

Case III. V. S., a girl, aged nineteen, a student nurse at Montefiore Hospital, noted blood-streaked sputum about a week prior to her admission as a patient. Several days later she had a frank hemoptysis of about three ounces of blood. Otherwise, she had few complaints and no cough or expectoration. Significant in this case is the fact that in September, 1929, seven months prior to her present illness, she had been examined and roentgenoscoped by Dr. S. Biloon, as part of a general examination given to all matriculating student nurses, and no abnormalities were noted in the lungs. She weighed at that time 128 lb. and was in good health.

Physical examination at the time of her admission as a patient revealed evidences of pulmonary tuberculosis with cavity formation in the right upper lobe. The film revealed an extensive consolidation, the interlobar fissure being clearly visualized. In addition there were scattered tubercles in the remainder of the right lung with suggestive cavity formation below the level of the fissure. The left lung was uninvolved (Fig. 5). During her hospital stay of one month she coughed up small amounts of

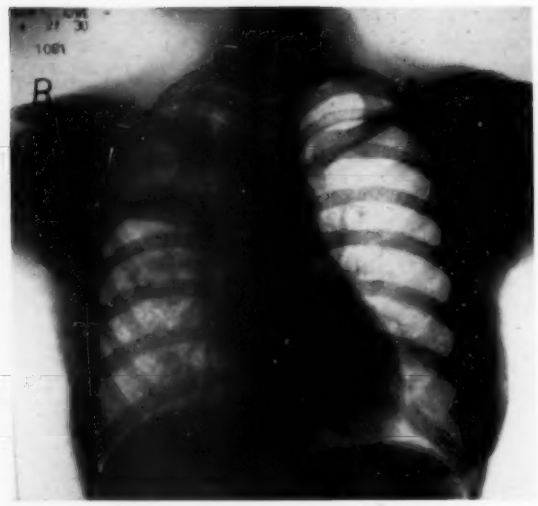

Fig. 5. Case III. April 21, 1930. Consolidation occupying the right upper lobe with evidences of cavitation. Infiltration and cavitation below the sharply outlined fissure. Left lung clear. The history in this patient, a nurse, dated one week.

blood on several occasions. The last two weeks of her stay were uneventful.

Two months after her discharge she was admitted to the Mountain Sanatorium, Hamilton, Ontario. At this time, she had bilateral disease. From June, 1930, to May, 1931, she was under rest treatment. At the end of this period, the lesion in the left lung improved to an extent that artificial pneumothorax was attempted on the right side. Following the induction of pneumothorax she showed steady improvement. The sputum became negative for tubercle bacilli in January, 1932, and remained so until her discharge, February 14, 1933 (Fig. 6). Two months before she left the Mountain Sanatorium, she evidenced psychotic tendencies. She returned to the United States and was committed to an insane asylum. Here she was found to have dementia praecox, catatonic type. Roentgen examination of the chest in the latter institution revealed "infiltration and fibrosis of both upper lobes, more marked on the right side."

The malignant type of lobar tuberculosis evolves as a caseous pneumonia in which case there is rapid necrosis and excavation of the lobe or else, in rare instances, the patient succumbs before the lesion has had time to ulcerate. The following instance in which it was possible to examine the lungs at autopsy is an excellent example of the latter condition. We have seen only one other similar instance in over 800 post-mortem examinations.

Case IV. A. D., a man, aged twenty-five, became ill about a week before admission to Morrisania City Hospital, with cough, fever and night sweats. He had no pain in the chest, chills or bloody sputum. On admission the temperature ranged to 104° F., the pulse was rapid, there was slight dyspnea and other evidences of toxemia. Physical and roentgen examinations revealed signs of a dense consolidation in the right upper lobe (Fig. 7). Although the sputum was repeatedly negative for tubercle bacilli, a diagnosis of caseous lobar pneumonia was made and, at the suggestion of Dr. D. Greenberg, pneumothorax was induced. Following several inflations of air, there was noted some subjective improvement but the films showed a gradual progression of the disease in the lower lobes (Fig. 8). Pneumothorax was discontinued. Late in the course of the disease a single smear showing tubercle bacilli was obtained and also a positive guinea pig inoculation. The patient died six weeks after his admission to the hospital.

The post-mortem examination revealed the following: The right chest cavity was occupied

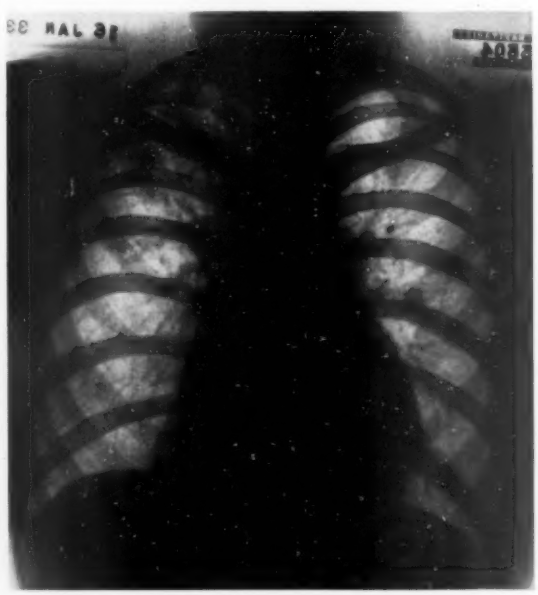

Fig. 6. Case III. January 16, 1933. At the time of pneumothorax discontinuation. Fibrotic infiltrations in right upper lobe. (Courtesy of the Mountain Sanatorium, Hamilton, Ontario.)

by a pneumothorax and about 100 c.c. of serous fluid. The right lung was free in the pleural sac except for a few easily torn adhesions at the base. The surface of the right lung showed yellowish mottling beneath the pleura. The organ was solidified throughout with no areas of crepitation being made out so that on removing the lung it rigidly maintained its contour. Although the lung was firm there were no areas of definite hardness to suggest fibrous tissue or calcified areas. On section (Fig. 9), the entire parenchyma of the lung seemed to be almost wholly replaced by a yellowish friable material, scattered in areas ranging in size from pinpoint to several centimeters in diameter, the latter apparently due to coalescence of smaller areas. The distribution of this mottling was uneven. There were no signs of pre-existing tuberculosis. There were no areas of ulceration or cavity formation. The pleura was nowhere thickened. The left lung was entirely free in the pleural sac which contained a small amount of serous fluid. The parenchyma, on section, revealed small areas of irregular yellowish material similar to that in the right lung. The hilar lymph glands were of pea size and blackened. Microscopic examination revealed the characteristic picture of tuberculous caseous pneumonia. Nothing remarkable was found in the other organs of the body.

Fig. 7. Case iv. June 14, 1933. Density in right upper lobe, delineated by interlobar fissure. Left lung clear. Sputum persistently negative for tubercle bacilli. Clinical course of malignant lobar tuberculosis.

Fig. 8. Case iv. July 1, 1933. Pneumothorax partly compressing the right lung. The process has spread in the lower parts of the lung.

TREATMENT

As was mentioned previously, treatment is often delayed because of difficulties in arriving at a correct diagnosis. At times, the condition is confused with lobar pneumonia, at other times, with pulmonary neoplasm or suppuration, rarely, with interlobar effusion. Lack of space prevents our citing a number of illustrative instances. The greatest difficulties in differential diagnosis arise at the inception of the disease. In some patients tubercle bacilli are found in the sputum on the first examination. In others, as in the last case

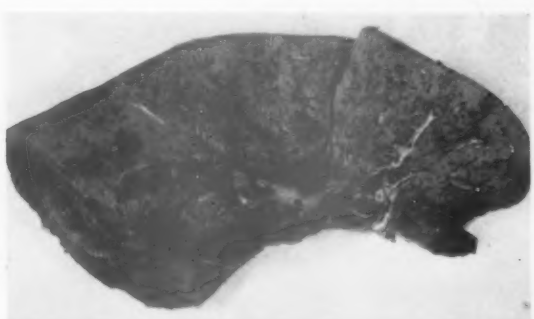

Fig. 9. Case iv. Cross section of lung. Caseous pneumonic, non-ulcerative tuberculosis. Guinea pig and direct examinations positive for tubercle bacilli.

reported, tubercle bacilli cannot be found until late in the course of the disease. Patients with benign lobar tuberculosis, particularly children, may not reveal tubercle bacilli in the sputum at any time during the course of the disease so that the correctness of the diagnosis always remains a matter of doubt.

In the treatment of the initial lobar infiltrate, pneumothorax is often a necessity and is administered early in the course of the disease. As a rule, air is easily injected into the pleural cavity and few adhesions are encountered. The film may reveal the diseased lobe to be collapsed to a degree that is quite striking. This would suggest the possibility that in these instances there is an associated atelectasis of the lobe. When the interlobar pleura, as well as the general pleural cavity, is free of adhesions, the affected lobe may become completely collapsed against the mediastinum and in time the healthy lobes become vicariously enlarged so as to fill the place normally occupied by the dislocated lobe. We have encountered such an instance in a young diabetic boy who had tuberculosis in the right lower lobe. Similar instances have been recently reported by others.[3,4] In some patients the diseased lobe is accompanied by an early adhesive pleuritis, making it impossible to produce an adequate collapse of the lung. When the lobar involvement is symptomatically benign, pneumothorax can be withheld and the course of the disease carefully watched. It must be emphasized, however, that at the outset neither the clinical nor the roentgenological findings are safe guides to prognosis. The evolution of the disease can only be determined from subsequent events. In this respect, the importance of frequent roentgenograms cannot be overestimated.

SUMMARY

Instances are described of initial lobar tuberculosis having a predilection for the right upper lobe that vary greatly in their mode of evolution. In some instances, these lobar infiltrates are relatively benign. In others, the disease assumes a malignant character and results in a fatal issue in a few months. These tuberculous lobar infiltrates are frequently confused with lobar pneumonia, neoplasm or suppurative disease. The benign types of lobar tuberculosis respond readily to rest treatment; the more acute types often require artificial pneumothorax. At the outset of the illness it is difficult to prognosticate the probable course of events.

I am indebted to Dr. Farn B. Chu for his help and interest in this study.

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Vol. 34, No. 2

OBSERVATIONS ON THE ROENTGEN PATHOLOGY OF ETHMOID LABYRINTH AND SPHENOID SINUSES*

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INFECTION of the paranasal sinuses is daily assuming a place of more importance in medical and surgical consideration. The roentgenologist is called upon more frequently to aid in establishing a diagnosis of sinusitis or to indicate the extent of involvement. The progressive rhinologist accepts without question roentgen evidence of pathology in the maxillary antrum and frontal sinus. He does not, however, give much credence to roentgenological opinion regarding the presence or absence of disease in the ethmoid labyrinth or sphenoid sinus. This fact would indicate that a satisfactory technique has not been evolved, or that we are unwilling to perfect ourselves in the interpretation of films made by a procedure strange to us.

In the laboratory we are utilizing the technique described by Rhese[5] for the roentgen study of the ethmoid labyrinth and sphenoid sinuses, and we have found this position most useful and instructive. We have not deviated from his description except that we make a stereoscopic set of films.

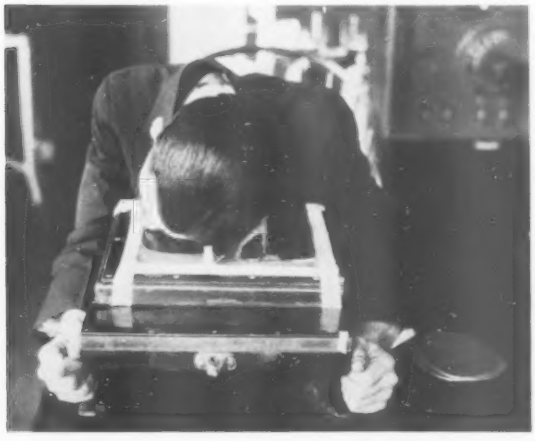

FIG. 1. Shows the patient's head in position for the film of the left side, Rhese position.

I have had the opportunity to study a series of 500 cases by this method, cases which have subsequently come to operation. I have personally studied the gross

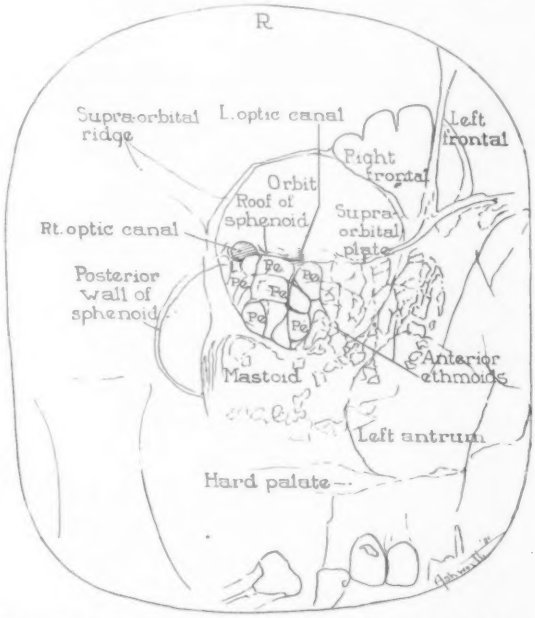

FIG. 2. A schematic tracing of the right side of roentgenogram shown in Figure 3. *P.e.* denotes post-ethmoid cells overlying the lateral wall of the right spenoid.

specimen with the surgeon and together we have reviewed the roentgenograms, transcribing the shadowgraph into a picture of the gross pathology. We have studied the microscopic slides of these tissues or the report of the pathologist, and have again compared these observations with the roentgenograms.

The Rhese technique is simple after one has had a little experience with it. It is rapidly done and gives the most unobstructed view of the ethmoid and sphenoid sinuses. The patient's head is so placed (Fig. 1) that the external orbital margin and the nose are in contact with the plate

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changer. The chin is raised slightly in those individuals who have a narrow mandibular arch, and depressed in those who have a wide arch, so that the petrous portion of the temporal bone will not be projected over the ethmoid cells. The sagittal plane of the head is at an angle of about 45° with the plate. The central ray is perpendicular to the film and is directed through the orbit in contact with the plate changer from the opposite occipitoparietal region. just below the shadow of the external orbital ridge, and is the canal of the side in contact with the film; the opposite canal is projected well forward (Fig. 4). We identify the roof and posterior wall of the sphenoid next to the film. This is true in all cases except those in which the cavity of one sphenoid is greatly enlarged at the expense of the opposite sinus. This anatomical variation is not infrequently observed.

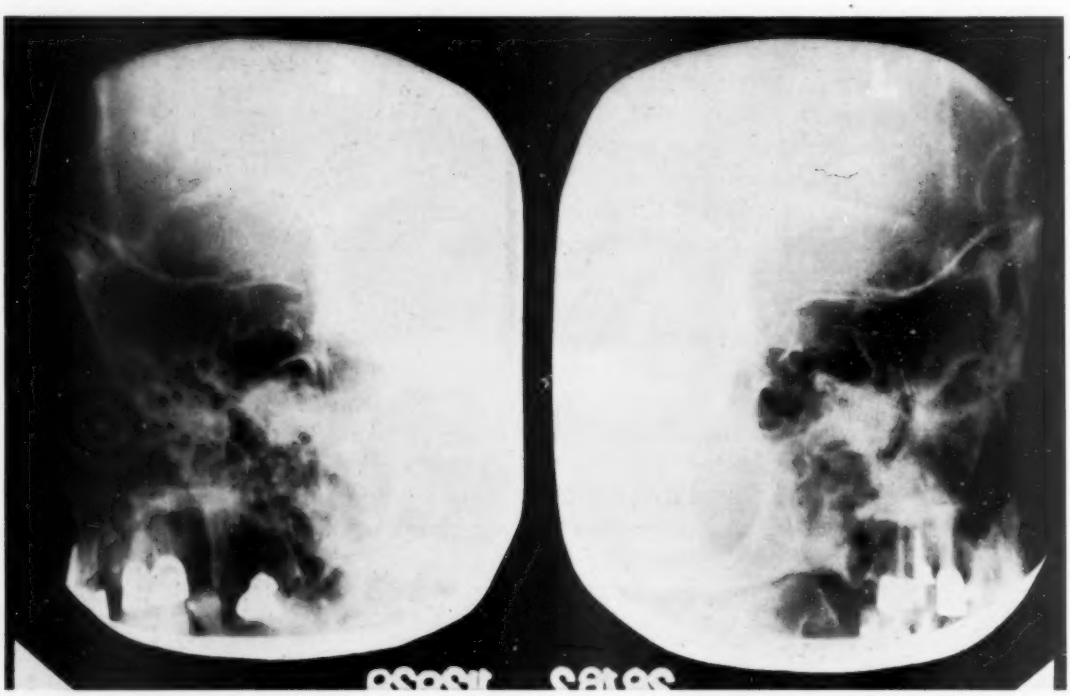

Fig. 3. Roentgenogram of a normal case. Note the sharp intercellular trabeculae of the ethmoid cells and the clear margins of the sphenoids.

Stereoscopic films are made of both sides.

The position will project the ethmoids and sphenoids into the orbit. The lineal marking which almost bisects the orbit is cast by the cribriform plate of the ethmoid, mesially, the supraorbital plates of the frontals laterally and posteriorly by the roof of the sphenoidal sinuses (Figs. 2 and 3). Beneath this lineal marking are seen, posteriorly, the sphenoidal sinuses. Posterior to the roof of the sphenoid is the optic foramen; this structure should lie just within the lateral margins of the orbit and

The posterior ethmoids of the side next to the film are quite unobstructed but the few anterior cells of the posterior ethmoids and all of the anterior cells are overlaid by the ethmoids of the opposite side. We must depend upon stereoscopy to study these cells. The position admits of further study of the frontal sinuses and is excellent in studying the antra in those cases in which an opaque medium has been injected, since it permits a view of the anterolateral and posterolateral margins of both antra.

The films must be made with a low kilo-

voltage. High penetration will destroy the detail necessary for the recognition of ethmoiditis. Our aim is to produce films of a quality that will permit us to demonstrate our findings without question.

Interpretation of the films is not difficult. The application of the principles involved in interpretation of any roentgenogram is all that is necessary. The basis is the comparison of the histology of the normal sinuses with the histopathology of disease. Normally the ethmoid cell has a bony wall lined by a thin mucous membrane which contains a few glands, blood and lymph vessels, and is covered by pseudo stratified, ciliated columnar epithelium; this cell normally contains air, so that roentgenologically this structure appears on the films as an area of diminished density surrounded by a thin sharp line of increased density cast by the bony wall, the covering of which does not cast a shadow (Fig. 5). These facts also hold in the sphenoid sinuses.

The acute infection which attacks these cells creates an edema, with cellular infiltration. Exudation of the serous fluid, cellular infiltration and desquamated epithelium form the discharge which fills the cell. The normal air content is displaced. Films in this state show a gray homogeneous density throughout the ethmoid labyrinth and sphenoid. The normally sharp trabeculae are almost obliterated.

Fig. 4. The left sphenoid is filled with opaque medium. Note the relative position of the left sphenoid when right orbit is in contact with the film.

Healing may take place after the acute process subsides. Frequently, however, there is a continuation from the subacute stage to the chronic, with organization of the cellular infiltration, thickening of the mucous membrane, and hyalinization of the basement membrane. The epithelial lining becomes thickened; there is layer on layer of cuboidal cells, covered by columnar cells with short cilia. The perios-

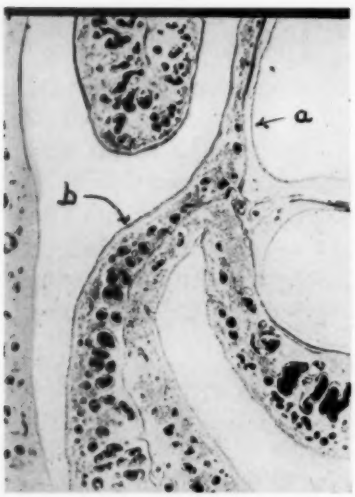

Fig. 5. Low power photomicrograph showing the relative thickness of nasal and antral mucosa; *a*, sinus mucosa; *b*, nasal mucosa.

line between the thickened tissue and the air space.

The rhinologist may objectively demonstrate a little thickening in the sphenoethmoid recess, but he has come to rely on the roentgen findings to show the extent of the involvement. The progressive rhinologist is becoming more and more interested in this chronic hyperplastic type of sinus disease, and in this type the roentgenologist can be most useful.

Mr. L. T., aged twenty-eight, had had frequent colds for five years and when he presented himself, he had fever, pain and swelling over the left frontal sinuses. Clinical, laboratory and roentgen evidence pointed to purulent left pansinusitis. Under conservative treatment the condition subsided, but did not disappear.

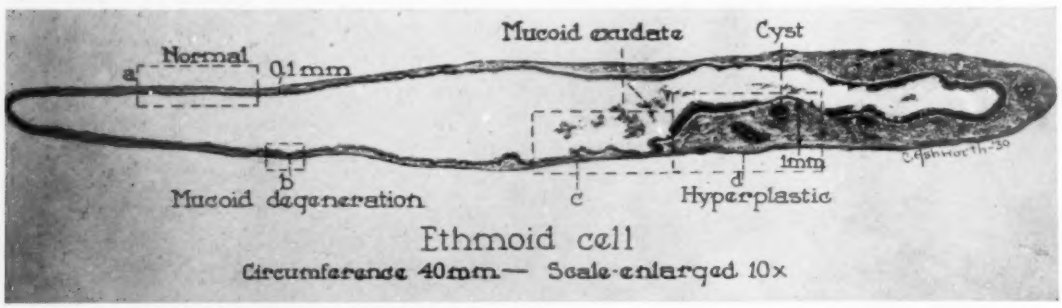

Fig. 6. Low power cross section of the entire lining of an ethmoid cell from the case of Mr. L. T. (circumference 40 mm.).

teum is frequently thickened and irregular bony deposits occur. Degenerating gland cysts are present, and it is always possible to demonstrate bacteria in the deep layers of the thickened tissue histologically. The films of a patient presenting this histopathological picture will show a blurring of the normal sharp intercellular trabeculae of the ethmoid labyrinth together with an increased density because of diminished air content; often one can make out the polypoid thickening within the larger ethmoidal cells. In the sphenoid the change in roentgen appearance is the same, namely, a blurred raggedness of the margins. It is the rule in this sinus to demonstrate clearly the thickened polypoid lining because the greater air content makes a sharp contrast

Headache, vertigo, tenderness in the left frontal region, and a moderate purulent discharge continued for three months, so it was decided to perform an intranasal frontal drainage. The patient was kept under continued observation. For the next six months the distress and discharge continued in spite of the previous treatment. The patient was advised to have an external frontal and ethmoidectomy. At operation, 260 days after the purulent sinusitis appeared, a large frontal sinus filled with mucopus and lined by a thick, soft rough and dark red membrane was found. The immediate ethmoidal cells were opened and found to be definitely hyperplastic but devoid of secretion. Figure 6 is a hyperplastic ethmoid cell from this case, showing a cross section of the entire cell. Note the relative thickness between that portion of the lining which is normal and the thickened hyperplastic tissue. Figure 7 is the

photomicrograph taken from the normal and hyperplastic portions of the cell shown in Figure 6. Note the relative thickness of epithelium, the induration of the submucosa, and the degenerating gland cyst. This is a typical section from a chronic non-suppurating sinusitis. In the roentgenograms (Fig. 8) of this case, note the lack of sharply outlined intercellular trabeculae. This finding is much more important than an increase in density and is typical of chronic non-purulent sinusitis.

This case demonstrates the usual sequence of events in a chronic non-purulent sinusitis following an acute purulent sinusitis. The rhinologist usually does not have the opportunity to observe the patient through the acute stage; he often requires a roentgenological study to establish his opinion when the patient comes with cardiac, respiratory or articular complications of infectious foci in the sinuses. He does not need roentgenograms in those cases in which objectively there is pus in the nose and signs of acute inflammation.

It is our hope that this brief summary of the roentgen pathology has been sufficient. These are in truth the sum of the observations necessary to give an opinion. There are all gradations of shadows seen, from the clear, sharp outlines noted in a normal sinus to the mottled blurring of the aggravated case of long-continued hyperplastic pansinusitis. A few cases may serve to illustrate these points.

Case I. Male, aged fifty-two, came to the clinician suffering from respiratory discomfort—profuse expectoration, wheezing and coughing. Of late a cardiac complication had developed. A type of toxic heart was found and he was referred to the otolaryngologist for study. A large polyp was found in his nose, apparently protruding from the ostium of the antrum. On roentgen examination (Fig. 9) the ethmoids showed a general density, markedly diminished aeration; the structure was partially obliterated, indicating a hyperplastic ethmoiditis. The right sphenoid showed a moderate hyperplasia, the left sphenoid was much more dense, and the margins showed a greater thickness of hyperplastic tissue. Figure 10 shows the gross specimen of one of the ethmoid cells and sphenoid to be actively inflamed. Both are thickened and hyperplastic. This case demonstrates the value of roentgenograms in the ethmoid and sphenoid. A radical operation of the antra and frontal sinuses only would certainly give little permanent relief.

Fig. 7. Photomicrographs taken of areas *a* and *d* of cell shown in Figure 6. Note the relative thickness of mucosa and submucosa.

Case II. This case of retrobulbar neuritis is important because it illustrates a non-suppurative sinusitis as a latent focus. The patient, a girl, aged twenty-two, was referred by the oculist for study because of an optic neuritis with a central scotoma. To quote the rhinologist, "There is nothing in the patient's history, past or present, to suggest a chronic sinus infection." Objectively examination was inconclusive. Roentgen study showed a moderate but definite involvement of the antra. The ethmoid labyrinth (Fig. 11) shows a definite thickening and a moderate density. In forming our opinion we must pay more attention to the sharpness of structure than to density. The sphenoids show very little density; the margins, though, are definitely hazy. The gross specimen shows a moderate hyperplasia throughout both sphenoids and ethmoids (Fig. 12). Alpha hemolytic streptococci were cultured from both

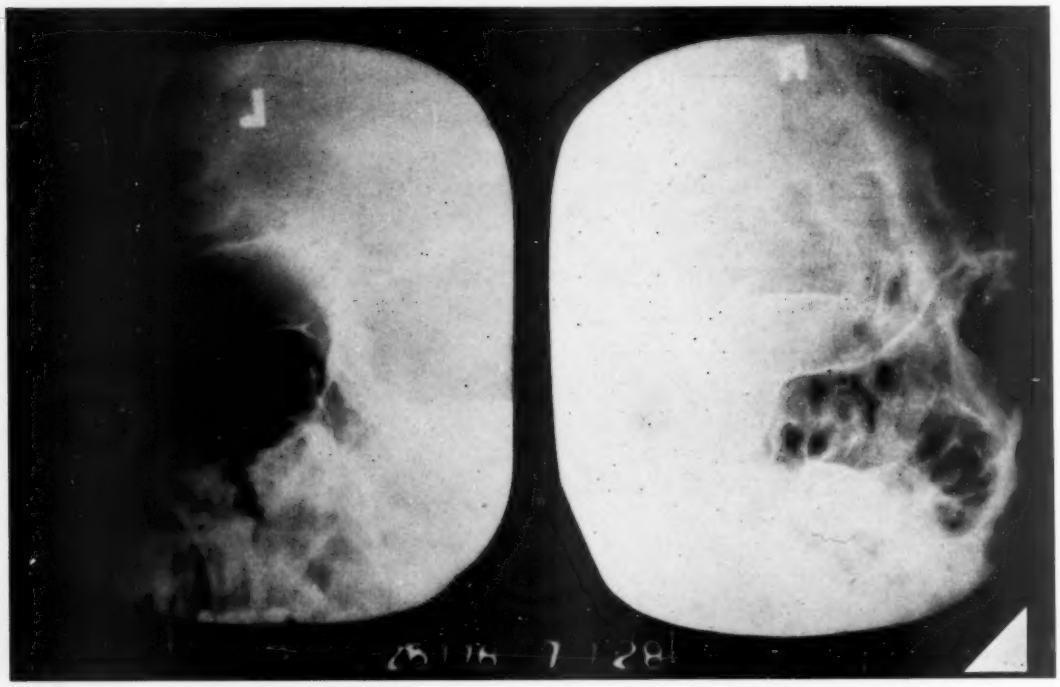

Fig. 8. Roentgenogram in case of Mr. L. T. Note lack of sharp structure in ethmoid labyrinth.

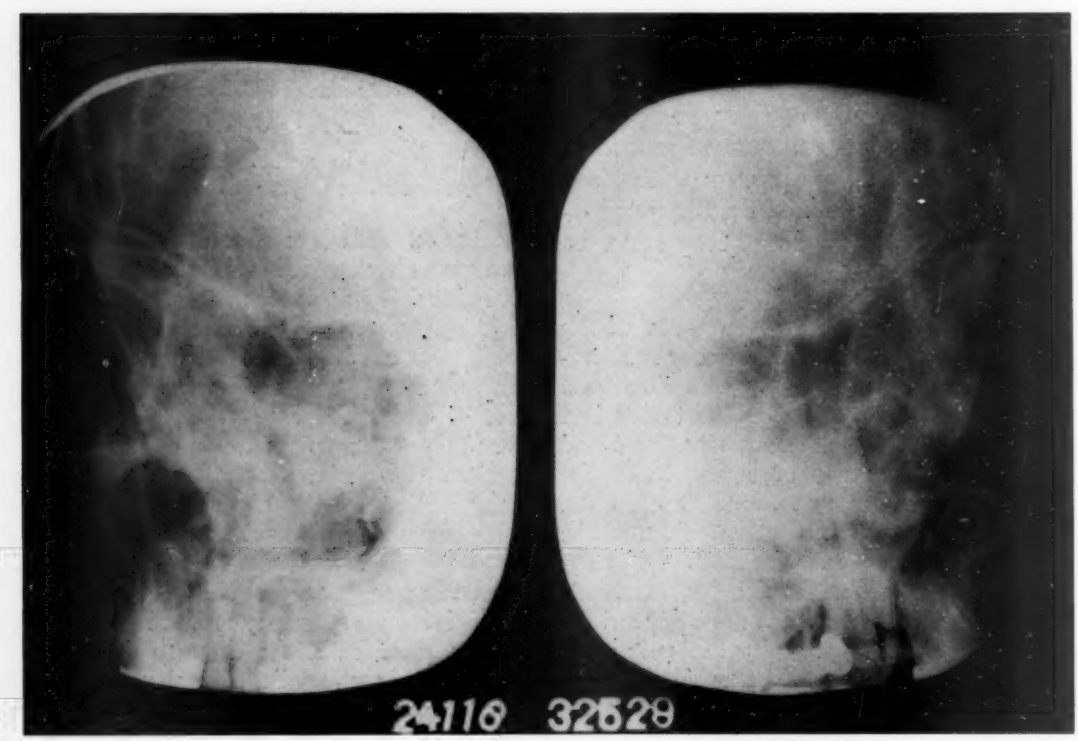

Fig. 9. Case 1. Note density and lack of structure of ethmoids and the thickened hazy borders of the sphenoids.

sides. The sections show a chronic change with fibrosis, edema, and cellular infiltrate. The epithelium has lost its columnar appearance and there are no cilia present. Figure 13 is a high power photomicrograph of the left sphenoid in this case. The typical eosinophiles with bilobed nuclei are seen. The general structure of the lining of the sphenoid is that seen in any case of hyperplastic sinusitis.

Fig. 10. Case I. Gross specimen from the sphenoid and one ethmoid cell. The sphenoid is dusky red due to active inflammation. Both are hyperplastic.

Case III. Mrs. D. T., a widow, aged fifty, well until 1924, when she suffered swelling, stiffness and pain of both knees. Extraction of all teeth in 1924. Cholecystectomy in 1925. Each of these procedures gave temporary relief. In 1928 the patient contracted a cold in the head which lasted for some time and was followed by a reappearance of the joint symptoms. At the time of examination she was having a nasal discharge. Examination showed a few râles in the lower lobes of both lungs and evidence of arthritis in the extremities. Roentgen examination of the sinuses showed involvement of both antra and frontals. Figure 14 shows the roentgenogram of this case. The ethmoid labyrinth is blurred and there is involvement of both the anterior and posterior cells. The density is greatest on the right side. Both sphenoids show involvement; the left sphenoid exhibits the homogeneous density usually found with empyema. A radical bilateral transantral ethmo-sphenoidectomy was performed. The gross specimen showed a

Fig. 11. Case II. Roentgenogram of ethmoids and sphenoids. Note the absence of density. The structure is hazy. Cell walls of the ethmoids are not sharp or clear. Sphenoid borders are thickened and ragged.

Fig. 12. Case II. Photograph of the lining of the left sphenoid and one ethmoid cell. Note the thickened irregular surface of the mucosa.

marked hyperplasia throughout with an empyema of the left sphenoid. Cultures of *Staphylococcus aureus* and alpha hemolytic streptococci were obtained.

The value of roentgen study in this case seems to me to be the demonstration of a hyperplastic right sphenoid. While the em-

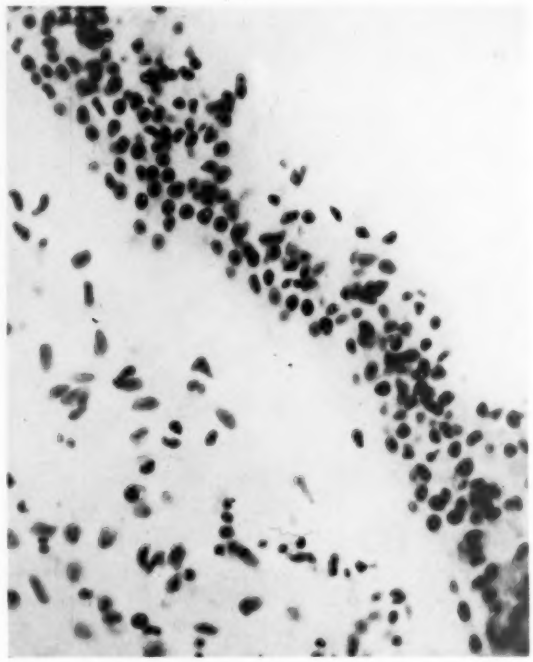

Fig. 13. Case II. High power photomicrograph of the left sphenoid, showing typical eosinophiles with bilobed nuclei.

Fig. 14. Case III. Roentgenogram of ethmoid labyrinth and sphenoid sinus. Note the density and lack of structure throughout the ethmoid cells. Note the density of the left sphenoid and the hazy margins of the right sphenoid.

pyema of the left sphenoid is certainly a noteworthy finding, yet operation of this sphenoid alone would surely have been followed by a surgical failure.

The study of the ethmoid cells when viewed from this oblique angle, where the entire labyrinth is spread out before one, is much more simple and accurate than to try to give an opinion as to the extent of involvement from the few cells seen on the anteroposterior films.

Statistics tending to show the accuracy of any diagnostic method have always seemed to us to be without real value, but the impressions that have been gained from the comparative study of roentgen films, gross specimens and their histopathology, have been very instructive.

SUMMARY

1. We believe that during the time we were learning to interpret these films we were ultraconservative in reporting ethmoid and sphenoid disease. Uniformly our reports indicated less involvement than the gross specimens and the microscopic examination later revealed. I believe this error was due to a remaining tendency on our part to pay too little attention to the detail of structure and too much attention to the degree of density.

2. Roentgen study has revealed many cases of diseased sinuses when the history has in no way given a clue to these foci and where the rhinological examinations have been inconclusive.

3. A new field of work has been opened up through the demonstration to skeptical rhinologists of the consistent value of roentgen examination.

4. It is imperative that the roentgenologist study the gross specimens and the pathological preparations of the tissues from the cases he has observed roentgenologically if recognition of the diseased sinus is to be obtained.

I wish to express my appreciation to Dr. Frank B. Kistner for the privilege of studying this series of cases and the gross pathological specimens, and to the Pathological Department of the University of Oregon Medical School for the opportunity of studying microscopic sections of the tissue removed by Dr. Kistner.

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A ROENTGENOLOGIC FOLLOW-UP OF 125 CASES OF PEPTIC ULCER, WITH CLINICAL AND LABORATORY FINDINGS*

A ROENTGEN DEMONSTRATION OF CASES HEALED BY MEDICAL TREATMENT, AND THOSE WHICH REQUIRE SURGICAL TREATMENT

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IT IS my purpose to present a study of the results of medical treatment, and the indications for surgery, in peptic ulcer, as demonstrated by roentgen examinations considered in the light of clinical and laboratory findings.

In the Stomach Clinic at St. Joseph's Hospital in the past three and one-half years we have made clinical and roentgenological diagnoses of 139 cases of peptic ulcer. Of these, 8 could not be traced, and 6 have been traced but have not returned for roentgen examination, 5 of which are still ill, and one is well. There remain, therefore, 125 cases, or 90 per cent, which have been followed up by roentgenologic, clinical, and laboratory methods.

Of these 125 cases, all of which gave a clinical history pointing to peptic ulcer, and in all of which cases roentgen examinations showed an irritable, tender, or defective cap, 20, or 16 per cent, have been dropped from this classification after repeated examinations. In these 20 cases the duodenal defect disappeared, but certain symptoms remained, and by repeated roentgen examinations, by surgical or autopsy findings, the cases were finally diagnosed as follows:

Peritoneal adhesions	6
Chronic cholecystitis	4
Cholelithiasis	3
Chronic appendicitis	2
Brain tumor	2
High blood pressure	1
Right inguinal hernia	1
Neurasthenia	1

Had it not been that these patients were under the personal supervision of the same doctors during the whole course of their treatment, these 20 cases might easily have been recorded as cured peptic ulcers.

There remain, then, 105 cases of peptic ulcer, which have been personally studied from a few months to over three and one-half years.

Distribution. In these 105 cases of peptic ulcer, there were 10 gastric ulcers, 3 of which occurred in association with duodenal ulcers; there were 4 parapyloric, and 91 duodenal ulcers, including 3 associated with gastric ulcers, 5 with gastrojejunal ulcers, and 2 associated with pulmonary tuberculosis and tuberculosis of the gastrointestinal tract.

Number of Operations. There were 31 operations in these 105 cases. Eight cases perforated, of which 1 died, 1 is alive without operation, and the other 6 were operated on, 1 of which perforated while being treated by us, the other 5 giving a history of perforating at some previous time. Eleven had gastroenterostomies, 7 of which were ordered by us, 1 for persistent pain, 3 for obstruction, 3 for persistent ulcer after closure of perforation. Two had gastric resections. Seven had appendectomies for chronic appendicitis, 1 had a herniotomy, 2 were operated on for ad-

* I wish to express my indebtedness and appreciation to those who made this study possible. This follow-up could not have been attempted without the kindness and generosity of Dr. H.N. Golding, Head of the Department of Roentgenology, St. Joseph's Hospital. With his consent over 310 roentgenoscopic or gastrointestinal series were done, or nearly three roentgen examinations per patient. Thanks are also due to Dr. F. McDede, of the Stomach Clinic for his cooperation in allowing me full power to work out the cases as I desired, and to Dr. Kim, of the Laboratory, for permitting the 256 Ewald test meal examinations which were made in the course of the study. To Mrs. C. Ferris, Recording Secretary, and Miss A. Conners, of the Junior Auxiliary, belong credit for the important work of following up, by mail and personal visits, all those patients who were slow to return.

hesions, and 1 had a salpingectomy, all of which were performed before the patients came to the clinic, and it is probable in some of these last-mentioned cases that the patient's symptoms were due to the ulcer, and that the operations were performed on a mistaken diagnosis.

Number of Deaths. There were two deaths, one surgical after gastric resection, and one medical after tubation.

Unusual Complications. One case presented unusual complications: a subdiaphragmatic abscess, after perforation, resolved without operation.

ETIOLOGY

Factors Which Tend to Produce Peptic Ulcers.

1. *Body Type.* It has long been noted that those who suffered from peptic ulcer were apt to be of a certain body type. In our study there were 5 cases which showed the hypersthenic type of body, 14 cases showing the sthenic type, and 86 cases showing the hyposthenic type. In the hyposthenic type, in which the width of the pelvis is much greater than the width of the chest, the stomach descends into the pelvis. This causes a sharp angulation between the first and second part of the duodenum, which puts the first part of the duodenum and the pyloric end of the stomach under a great stress and makes it easy for an ulcer to form by allowing a greater accumulation of acids in the stomach for a longer period than normal, and by preventing to a great extent bile, pancreatic, and intestinal juices from regurgitating to neutralize the acids. This action is enhanced by mechanical interference in the blood supply to this region which affects the state of nutrition of the various alkali supplying glands, such as the goblet cells in the antrum and Brunner's glands in the duodenum, and which also affects the thickness and condition of the mucosa of the pyloric end of the stomach and the duodenum. Evidently the duodenum is under a greater strain that the stomach,

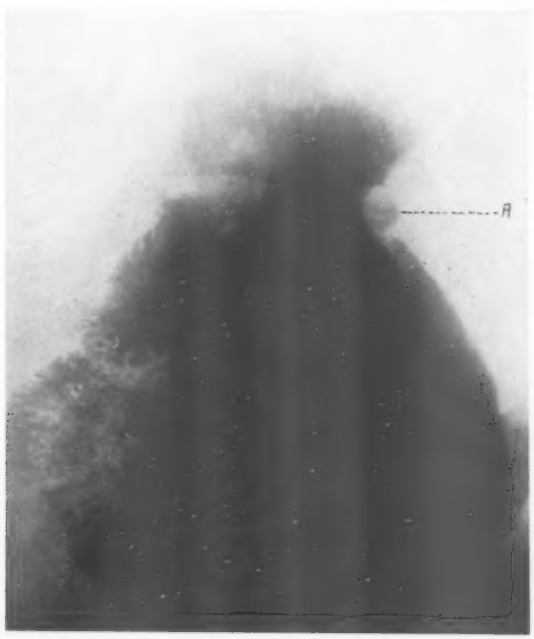

Fig. 1. Peptic ulcer of cardiac end of the stomach (healed). L. B., 1930. No prodromal symptoms, pains ½ hour p. c. for two years, tenderness 4 plus; Ewald test meal, total acidity 50; free HCl 30, blood 0, time 30 minutes. Tube method of treatment, three weeks.

Fig. 2. L. B. Five hour plate shows small gastric residue in ulcer crater at *A*, and little gastric residue in lower end of stomach.

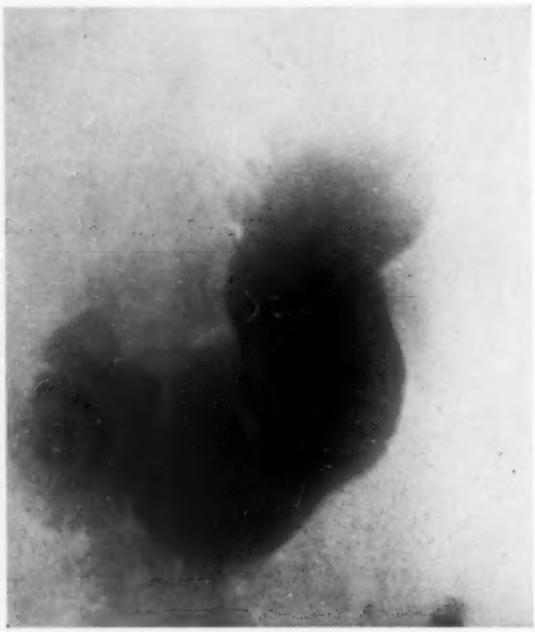

FIG. 3. L. B., 1933. No roentgen evidence of cardiac ulcer. Patient has been well forty-two months. No tenderness; test meal, total acidity 45, free HCl 26, blood 0, 40 minutes.

since duodenal ulcer is nine times as common as gastric ulcer in our series.

Not all hyposthenic individuals have peptic ulcers, nor are all peptic ulcers found in hyposthenic people, so hyposthenia is not the only cause of peptic ulcer. There follows, therefore, a summary of other factors contributory to the formation of a peptic ulcer. One group may be the exciting factor in one case, another group in another case.

2. *Temperament* (*Race*, *Sex*, *Age*). In this series 60 cases had a history of extreme nervousness. Of the others, 2 were dementia praecox, 1 dates the ulcer from an assault, 5 gave a history of having suffered deprivation at war. One patient believes his ulcer was caused by eating carbon dioxide ice, another, by swallowing dog pills, and still others, by drinking too much alcohol and smoking too many cigarettes. Three had very bad teeth. In the latter cases, of course, it is probable that infection was the important factor.

It is interesting when noting the nervous element in these cases, to consider what effect disturbances in the nervous system may have on the production of peptic ulcers.

We had 2 cases of brain tumor, 1 of which involved the pineal gland, and the other, the lateral hemisphere. In these cases there was an increased secretion of hydrochloric acid, amounting to more than 100 degrees, and marked increase in the motor functions of the stomach and duodenum. These activities were probably caused by pressure stimulation of the vagus, secretory and motor centers in the medulla, or by increased stimulation of the pituitary gland, in its various endocrine secretory and motor functions.

It is also pertinent here to mention Cushing's[1] experience, that while operating on brain tumors, in 3 cases, perforations occurred in the upper gastrointestinal tract.

FIG. 4. Gastric ulcer, lesser curvature. (Healed and broken down several times.) R. R., 7.21.32. Prodromal symptoms fifteen years, gas, heart burn, fullness after meals. Pains 1½ hours p. c., ten years. Tenderness 4 plus. Ewald test meal, total acidity 28, free HCl 25, blood 0, time 25 minutes. Tube method of treatment three weeks. Note penetrating niche at *A*, and the surrounding inflammatory halo about it at *B*.

In a great number of cases of high blood pressure, gastrointestinal symptoms are quite common, and it is sometimes difficult, especially when they present a high acidity such as, in 1 of our cases, 180 degrees, and a cap which could not be filled because of reflex irritability, to differentiate between peptic ulcer and reflex irritability due to high blood pressure.

The race, sex, and age factors all tend to point to a nervous instability, since those races of high-strung temperament have the greatest number of ulcers, as the following figures show:

Irish	24	Negro	3
Italian	22	French	2
Jewish	15	Lithuanian	2
American	14	Turkish	1
Holland	9	Assyrian	1
German	5	Greek	1
Polish	5	Syrian	1

Note that there were 102 whites, and only 3 colored people. Also, there were 87 men to 18 women, a ratio of 5 to 1, in this group, in which the ulcers occurred almost entirely during the period of greatest strain and responsibility, the decades being represented as follows:

10–19	10 cases	40–49	24 cases
20–29	28 cases	50–59	4 cases
30–39	38 cases	60–69	1 case

3. *Acidity*. A factor which is often cited as of importance in the etiology of peptic ulcer is an increased amount of hydrochloric acid. In this connection the following figures will show how this group stood.

3 cases showed anacidity consistently
3 cases showed subacidity consistently
8 cases were consistently normal
29 cases were consistently hyperacid
62 cases were variable

Of the 256 Ewald test meals:

16 test meals showed anacidity
46 test meals showed subacidity

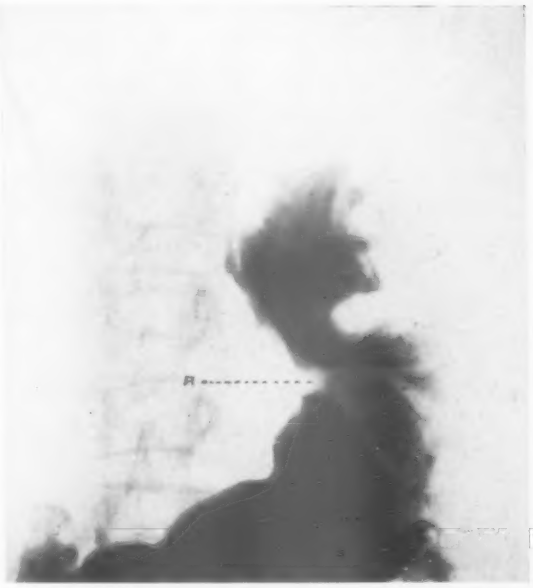

Fig. 5. R. R., 9.16.32. The penetrating niche has disappeared by treatment but the inflammatory mount is still present at *A*, with thickened rugae extending from it. The patient has had only occasional pains on dietary indiscretion. Tenderness 4 plus. Between 9.16.32 and 8.14.33, the niche appeared several times within the inflammatory zone. Each time the patient had indulged in some dietary indiscretion.

52 test meals showed normal acidity
142 test meals showed increased acidity

Therefore, more than half of the test meals showed increased acidity. It seems best at this point to give the results of the hydrochloric acid values taken when the patient was at the height of his peptic ulcer syndrome compared to those figures taken later in the course of his treatment, when his disease was cured, improved, or remained the same.

The figures give the percentage of patients in whom the acidity at a follow-up test meal was higher, the same, or lower, than in their previous tests at the height of the disease.

	Higher HCl	Same HCl	Lower HCl
1. Patients having no symptoms and roentgen examinations showing normal stomach and duodenum, or healed ulcer	20%	10%	70%
2. Patients having few or no symptoms, yet roentgen examinations show dormant ulcer	55%	11%	34%
3. Patients having symptoms and roentgen findings of active ulcer	85%	0	15%

These figures tend to confirm the finding that as the hydrochloric acid decreases the ulcer improves and heals, and as the hydrochloric acid increases the ulcer gets worse.

Etiology of Pain in Peptic Ulcer. It is of value, in the treatment of these cases, to discover what causes pain, the most important symptom in peptic ulcer. There are two theories as to the method of production of pain in peptic ulcer, first, that the increased production of hydrochloric acid irritates the nerves in the ulcer, and second, the mechanical theory, which will later be explained.

Against the theory of increased hydrochloric acid as the cause of pain, we have found:

1. Three cases of anacidity, and 3 cases of subacidity, which maintained these conditions consistently. We had 31 cases which, although they usually showed increased HCl, at some one time in the various examinations showed a decreased amount, the pain remaining the same.

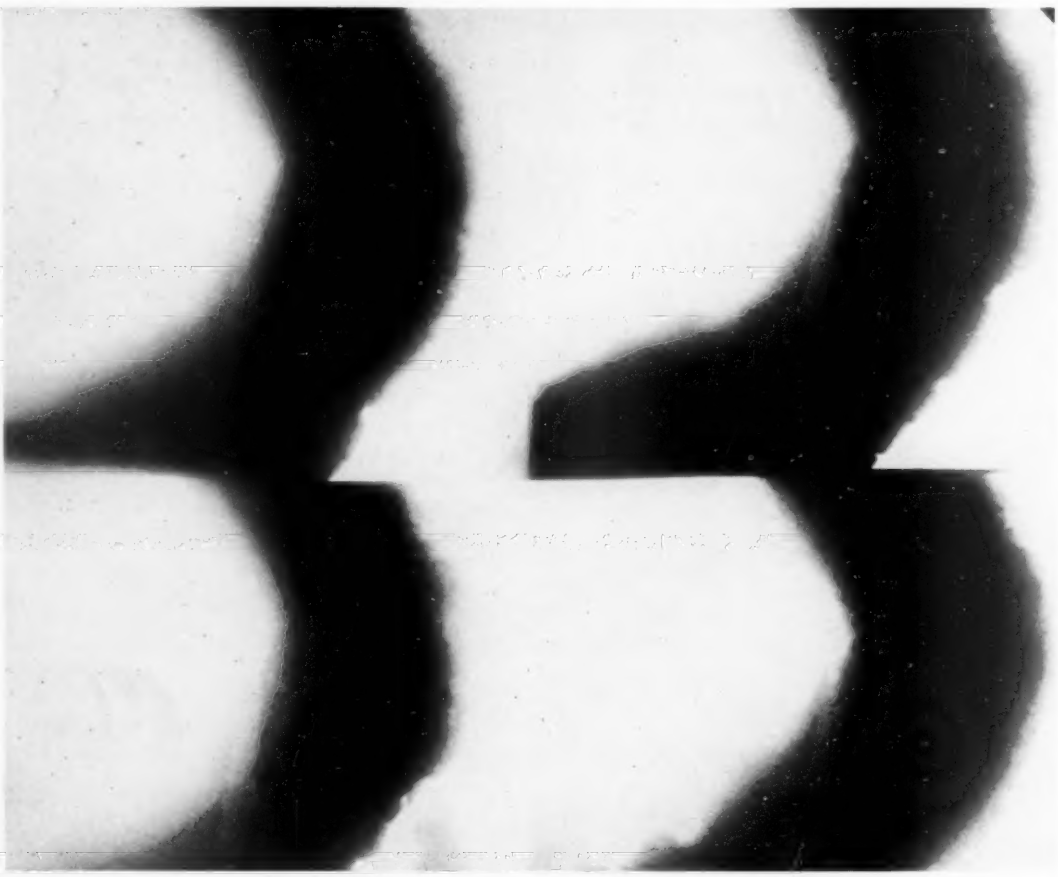

FIG. 6. R. R., 8.14.33. Both penetrating niche and surrounding halo gone. Only a few thickened rugae extend from the site of the previous disease. Patient has occasional gas pains, and still has 4 plus tenderness. Ewald test meal, total acidity 30, free HCl 14, time 35 minutes.
12.15.33. Both penetrating lesion and inflammatory mount returned. This case shows persistent recurrence of a penetrating lesion. The ulcer is always the same ulcer, and not a new one. The inflammatory lesion remaining after the niche disappears probably represents a dormant lesion.

2. In some cases administration by mouth of HCl actually relieved symptoms, and it has been shown that the application of HCl directly to the ulcer under local anesthesia did not cause pain.

3. In some patients the symptoms disappeared only when the amount of HCl in the stomach increased, and it was only when the

acidity reached its highest point that the roentgen defect disappeared.

4. Many people believe that the administration of alkalis relieves pain because the acidity is reduced, but many other factors which have no apparent effect upon the acidity cause the pains to disappear, as in one of our cases pain was relieved at one time or another by rectal dilatation, laxatives, powders, pills, drops, morphine, soft, hard, or liquid diet, lavage, tube treatment, removal of teeth, abdominal operation, etc.

The theory most widely accepted is that pain has to do with the mechanics of the stomach, and is produced in the same way as, normally, hunger pains are produced. That is, by over activity and increased tonicity of the muscles of the stomach. The only sensory end-organs the stomach has are those which respond to the stimulation of pulling. It has no sense organs, as the skin, which give a painful sensation by pinching, cutting, clamping, burning, etc. This theory explains how the gallbladder and appendix may give symptoms like those of an ulcer, reflexly, by increasing the muscular activity of the stomach.

Fig. 7. Prepyloric ulcer (healed). J. K., 5.13.31. Indigestion two weeks, no previous history or pains. Tenderness 4 plus. Ewald test meal, total acidity 78, free HCl 60, blood 0, time 30 minutes. Note prepyloric defect at *A*. Tube method of treatment.

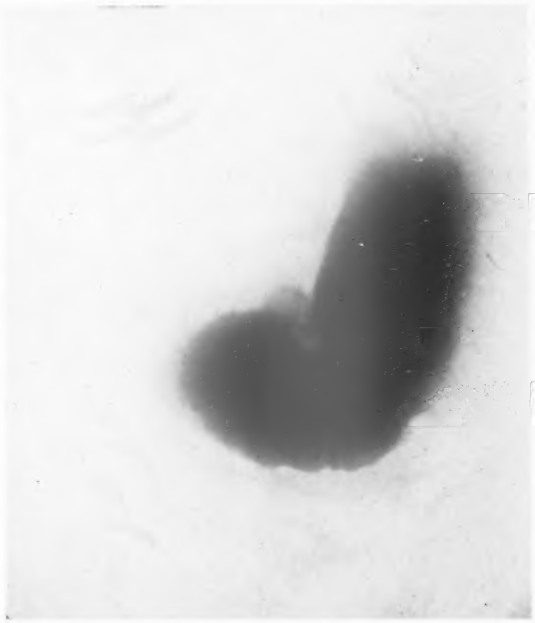

Fig. 8. J. K., 6.8.33. No roentgen evidence of prepyloric lesion. Well since treatment. No tenderness. Ewald test meal, total acidity 11, free HCl 7, blood 0, time 45 minutes.

Against the mechanical theory of pain: In a great many cases peristalsis was hardly seen, especially in long-obstructed cases, and yet these patients had as much pain as those cases which had a great deal of muscular activity. In fact, in these cases as the obstruction disappeared and the patient became symptom-free, the tone and peristalsis of the stomach increased. In many cases the patients were symptom-free at one time, or in great pain at another time, with the same amount of tone, the same number and depth of peristalses.

I believe that it is not enough to have merely an increased tonicity and peristalsis of the stomach to cause pain, but it is necessary that the base of the ulcer be attached to the muscle of the submucosa or the muscle coat proper. Normally the mucous membrane slides inside the stomach and duodenum, and, unless the ulcer is attached to the muscle, no tension can be made upon it by the muscular activity.

The ulcer can be attached to the muscle either by adhesions, by edema, or by inflammation. In this way we can explain the cases in which we actually have an increased tone and peristalsis, and yet no pain exists, by assuming that the ulcer is not attached to the muscle coat. It explains also how the same amount of tone and peristalsis may cause a great deal of pain in some patients, those whose ulcers are attached, and very little in others, whose ulcers have affected the mucosa only. It also explains how a deep, penetrating ulcer, after it has punched a hole in the stomach wall, and has become pocketed off, is quiescent, for no longer can the group of muscles it has disconnected cause tension upon it.

In evaluating pain in an individual, the nationality, individual peculiarities, different states of rest or fatigue, the state of the nervous system, the proper assimilation of calcium and potassium, and environmental conditions must be kept in mind. Any of these conditions may make the mechanics of the gastrointestinal tract more delicately balanced.

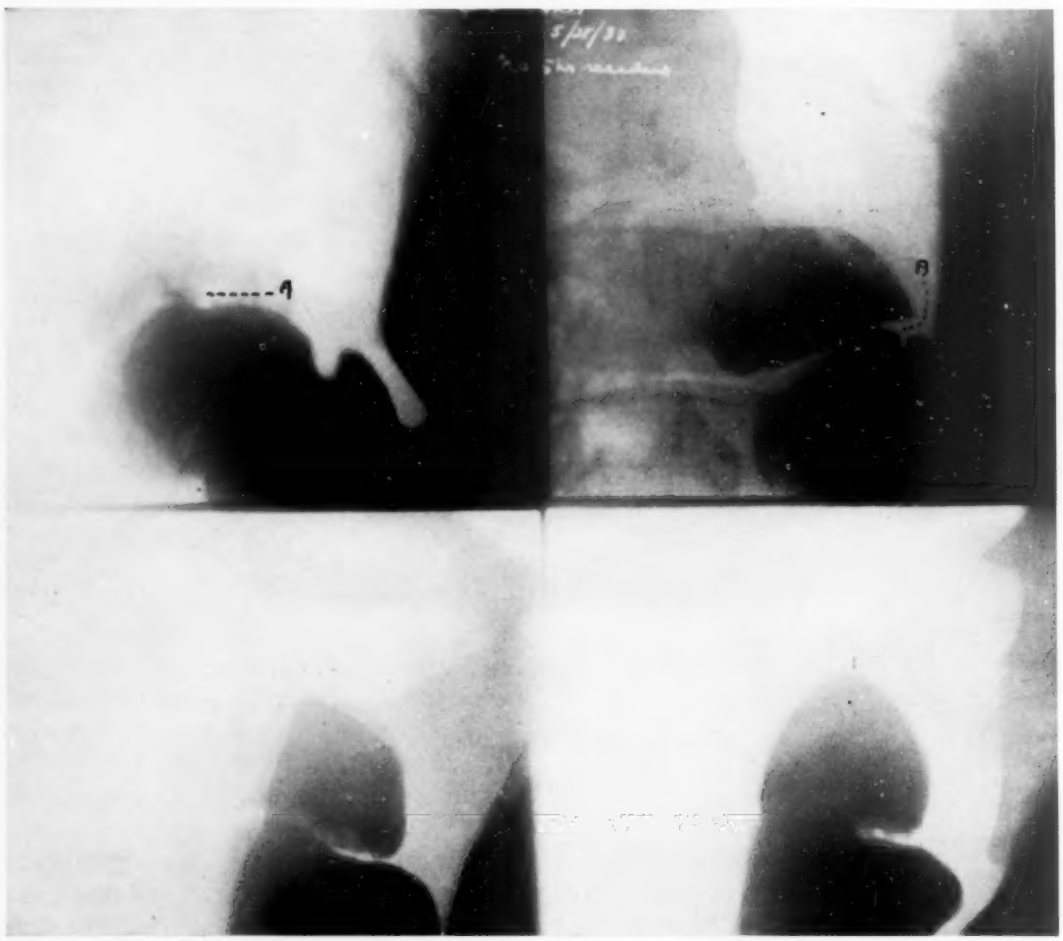

Fig. 9. Parapyloric ulcer (healed). Penetrating niche at *A*. L. C., 5.28.33. No prodromal symptoms. Pains p.c., three years. Tenderness 4 plus. Ewald test meal, total acidity 64, free HCl 53, Sippy diet and hospitalization.

Type of Treatment and Results. In evaluating the different types of treatment given these 105 patients, it must be kept in mind, first, that no clear-cut line can be drawn between the various treatments,

since most of the patients had more than one type, and second, that the length of time the ulcer had existed, the length of time of treatment, and the position of the ulcer, greatly influence the results.

In our cases the length of time symptoms existed is summarized in the following table:

TOTAL LENGTH OF TIME SYMPTOMS EXISTED IN ALL CASES

A. Before first roentgenogram was taken		
1. Average number of years of prodromal symptoms:		3.98 years
a. Number that had prodromal symptoms	36	
b. Number not having prodromal symptoms	36	
c. Unascertained	33	
2. Average number of years of pain (beginning of attachment of ulcer to underlying muscle)		6.2 years
a. Number that had pain	94	
b. Number that never complained of pain	3	
c. Unascertained	8	
3. Average length of time symptoms existed before first roentgenogram:		10.18 years
B. After first roentgenogram was taken		
1. Average length of time symptoms existed after first roentgenogram until patient was well, or if still ill, until January 1, 1934		2.6 years
Total length of time symptoms existed, average		12.78 years

From the following figures we can see that those patients whose ulcers improved had had symptoms, on the average, a shorter time than those whose ulcers did not improve.

Seven gastric ulcers were unaccompanied by duodenal lesions. Of these 7, one was operated on and died, 2 are unheard of, 1 healed and broke down three times, and 3 were completely cured by the tube

LENGTH OF TIME SYMPTOMS EXISTED BEFORE TREATMENT STARTED

		Type of Treatment		
		Tube	Sippy	Ambulatory Diet
Patients whose ulcer healed	Shortest time	3 wk.		2 wk.
	Longest time	20 yr.		26 yr.
	Average time	4.25 yr.	2 yr.	10.9 yr.
Patients whose ulcer did not heal	Shortest time	2 wk.	6 wk.	4 wk.
	Longest time	24 yr.	13 yr.	30 yr.
	Average time	10.4 yr.	8 yr.	11.3 yr.

Relation of Age to Cure. It is interesting to note here that the average age of the incidence of the ulcer in those who improved was 37.6 years, while in those who did not improve it was 30.4 years. Thus, the younger the patient is when he develops an ulcer, the harder it will be to cure it.

The length of time it took for an ulcer to heal under constant treatment averaged sixteen months. The shortest time was two months, and the longest time was forty-eight months. Those who are still ill have been under treatment for an average of twenty months up to January 1, 1934. Of course, with longer treatment some may still improve.

In this series we had 10 gastric ulcers. Three patients developed prepyloric ulcers while under care for their duodenal ulcers.

method of treatment. Of the 3 who were cured, 1 had had symptoms two weeks, another, one year, and the third two years, and the case which repeatedly healed and broke down had had symptoms for twenty years. In the majority of cases, gastric ulcers heal completely, and with shorter length of treatment than duodenal ulcers.

No matter how long the ulcer had existed, or what its position, the fact that the patient had undergone a tube treatment, or a Sippy diet, reduced the chance

of a perforation, requiring an operation, or of the patient's dying.

Twenty-two per cent of the cases on an ambulatory diet perforated, died, or required operation, whereas only 2.7 per cent of the patients who had the tube treatment or the Sippy diet met with these accidents.

The figures showing the number of cases in which the *symptoms* were improved or cured under the different treatments are as follows:

	Per Cent
Duodenal tube treatment and hospitalization	86
Sippy treatment and hospitalization	50
Ambulatory diet	54

But on the basis of symptoms, any type of treatment will give a cure at some time, since in most cases the ulcer becomes dormant and the symptoms disappear for a while, regardless of treatment. If, however, the roentgen findings are considered with the symptoms, the figures become significant and read as follows:

Type of Treatment	Improvement Shown by Roentgen Ray	Healing Shown by Roentgen Ray
	Per Cent	Per Cent
Duodenal tube treatment and hospitalization	69	39
Sippy treatment and hospitalization	30	20
Ambulatory diet	38	23

Even though the roentgenograms show healed peptic ulcers, it does not mean that the patients have no gastrointestinal symptoms. Following is a summary of the state of health of those patients whose roentgenograms showed a healed ulcer.

Fig. 10. L. C., 8.17.33. No roentgen evidence of parapyloric ulcer. Very few gastrointestinal symptoms, tenderness 0. Ewald test meal, total acidity 76, free HCl 58, blood 0, time 40 minutes.

Under the tube treatment with hospitalization, 39 per cent of the patients are cured, yet 80 per cent of this healed group give symptoms of indigestion, heart burn, or occasional pain or tenderness. Under the group treated by Sippy diet and hospitalization, 100 per cent of those classified as cured still have symptoms. The ambulatory diet group shows that 72.7 per cent of those classified as cured have gastrointestinal symptoms. Therefore the percentage of those who are entirely symptom-free and whose roentgenograms show a healed lesion, should be:

	Per Cent
Tube treatment and hospitalization	9.3
Sippy treatment and hospitalization	0
Ambulatory diet	5.76

I believe, however, that the figures 39 per cent for tube treatment, 20 per cent for Sippy diet, and 23 per cent for ambulatory diet, may be taken as giving the percentage cured, and that the fact that the majority of these cases have some stomach symptoms does not mean that their ulcer is not healed. Scarring, the end-result of healing, may be enough to cause their symptoms.

In a series of 7,700 autopsies performed at Bellevue Hospital, Sturtevant and Shapiro[2] found that 20 per cent of ulcers in the stomach or duodenum were healed. This group may or may not have been treated during life. Our figures are, because of treatment, a little higher.

Those who did not improve may still have a chance to do so, because very often a second tube or Sippy diet may be necessary to effect a cure. Also those lesions which are cured may still break down again as often happens.

It is evident that a 39 per cent cure by the tube treatment is not a very successful method of treatment in peptic ulcers. But our cases were very long existing ulcers, and with more prompt diagnosis and a quicker application of the tube method of treatment, with five or six weeks' rest in bed, and with a long diet regimen afterwards lasting from six months to three years, or if possible, until the roentgen examinations are negative for active lesion, I believe that the figure can be raised.

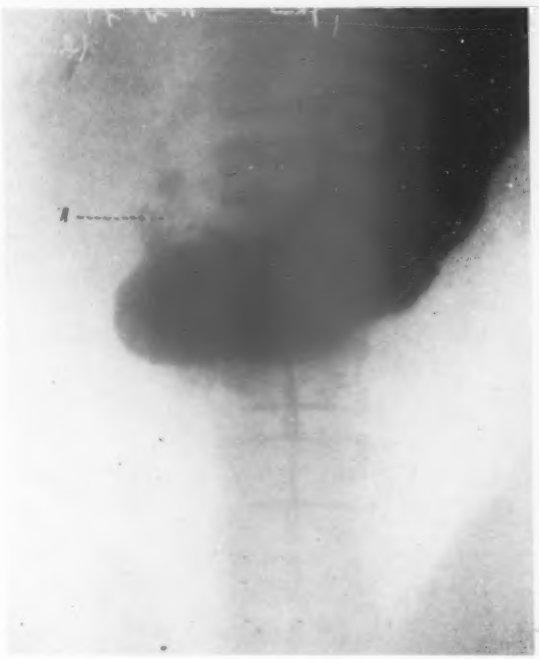

Fig. 11. Duodenal ulcer. (Healed without leaving roentgen defect.) Roentgenograms show a constantly defective cap at *A*. H. R., 11.21.29. Pains p. c., two weeks, no prodromal symptoms. Tenderness over duodenum 4 plus. Ewald test meal, total acidity 50, free HCl 41, blood 0, time 30 minutes. Ambulatory diet treatment.

As for surgery in the treatment of peptic ulcer, the results indicate that it should not be attempted in gastric ulcers. As for the fear that such an ulcer may turn to carcinoma I cite Brown's[3] experience in 77 cases of gastric ulcer, only 1 of which died of carcinoma, and in this case there was the healed scar of an ulcer near the carcinoma. Surgery should be resorted to only in the case of accidents resulting from the ulcer, such as perforations or perforating lesions, obstruction, persistent pain unrelieved by medical measures, and repeated severe hemorrhage.

Perforations. In an effort to determine what relationship exists between perforation and the activation of ulcers, I have made a graph based on the figures taken from St. Joseph's Hospital in the past four years, to show the relation of perforations

to the periods of the year when dormant ulcers become activated. It should be noted that ulcers tend to perforate about two months after they become activated (see Chart 1). Whereas ulcers become active and produce symptoms in January, May, and October, ulcers tend to perforate in March, August, and November. Chart 11 shows the relation of the age incidence of

maining 13 were still sick. Graves[5] says, "It cannot be denied that more than one-half of patients subjected to simple closure after perforation remain completely cured."

We had 8 perforations, of which 1 patient died from the perforation, but in the other 7 cases symptoms of an ulcer returned. The roentgenograms showed the same lesion after suture as before (see Figs. 22 and 23).

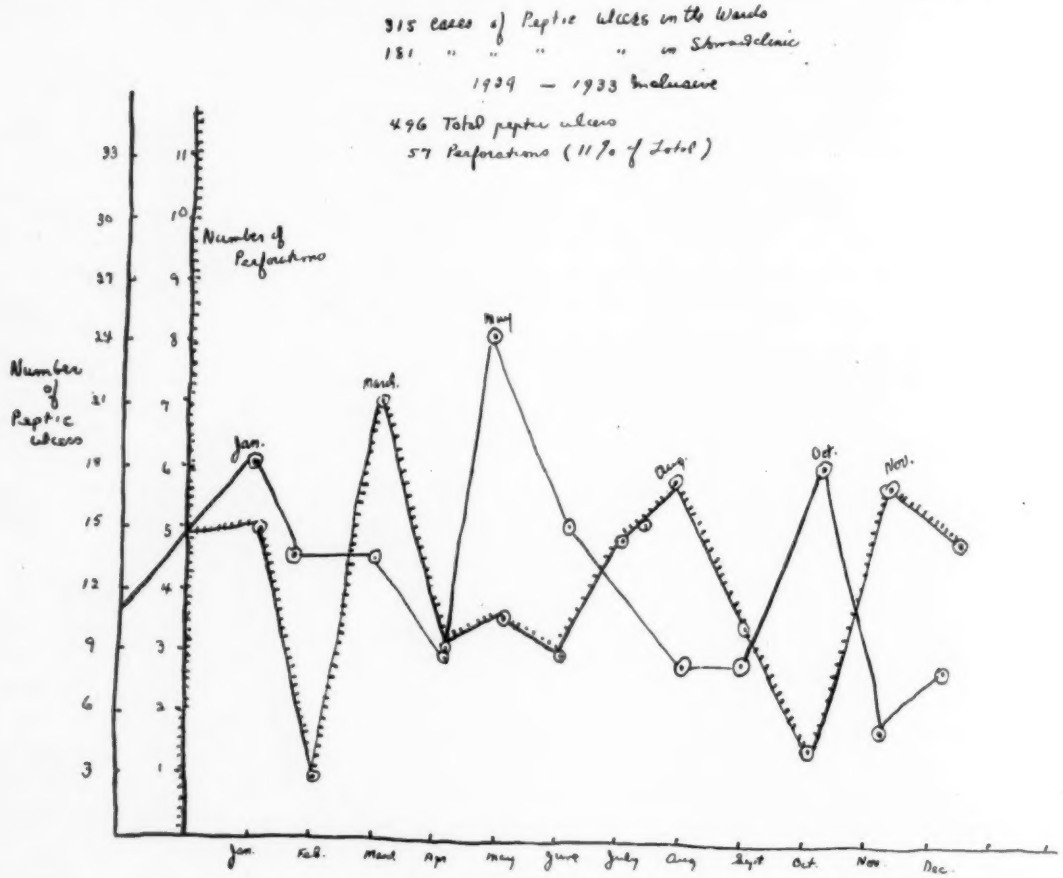

CHART I.

ulcers to the age incidence of perforation. It shows that perforations lag behind the ulcers, and that the older the ulcer patient is, the more apt he is to have a perforation.

I have been especially interested to know why peptic ulcers recur after the suturing of a perforated lesion. Lewisohn[4] says that in 33 cases of perforating peptic lesions 20 were well after operation which included a simple closure in 10, simple closure plus gastroenterostomy in 10 others. The re-

I believe that the methods of suturing are wrong. In hasty effort to save the patient's life, the edges of the ulcer are sutured so that it is actually reconstructed. The necrotic edges of the ulcer ought to be excised, if possible, before suturing.

Obstruction. Out of 105 cases of peptic ulcer, 27 were obstructed. Twelve were so greatly obstructed that 50 per cent or more of the barium meal remained in the stomach at the end of five hours, and 10 per

cent or more remained in the stomach at the end of twenty-four hours. Fifteen were only slightly obstructed, from 5 to 20 per cent remaining in the stomach at the end of five hours, and nothing remaining at the end of twenty-four hours. There were

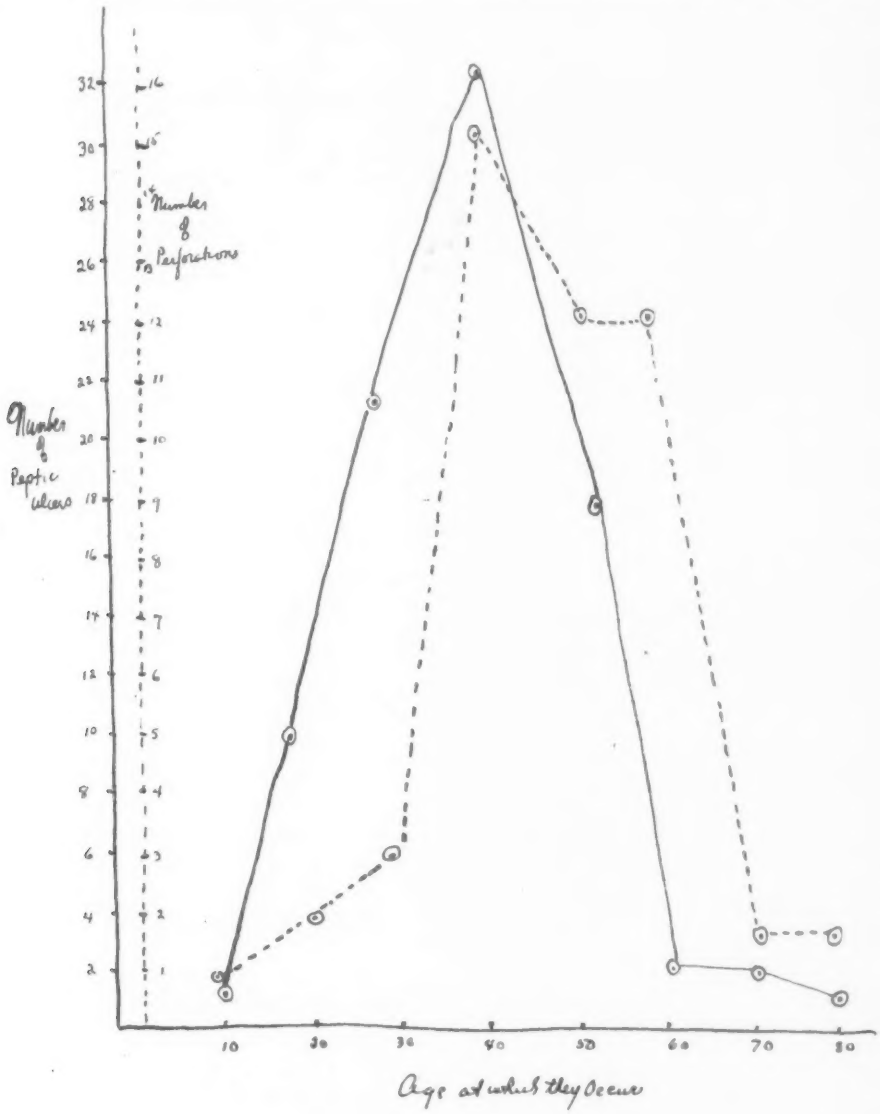

CHART II.

three causes for the five hour residue in our cases: (1) spasm of the pylorus, direct or reflex; (2) edema and inflammation about the ulcers near the pylorus; (3) scar tissue or adhesions near the pylorus.

Spasm usually occurs in all cases of peptic ulcer. This spasm at the pylorus is due to direct irritation by the ulcer when it is situated near the pylorus, or reflexly, when further away. It can be seen at the beginning of the examination, lasting ten minutes to one hour or more. In spite of this spasm, most ulcer patients do not have obstruction, because of the increased tone and peristalsis of the stomach which accompanies ulcers, but if the ulcer is of such a nature, or is so situated as to prolong the spasm, it may cause a five hour residue in the stomach.

Edema and inflammation about the ulcer

can exist independent of, or associated with spasm, and when near the pylorus 1 or 2 inches of the pyloric end of the stomach may not fill. Some barium can be forced into the cap after a long period.

Scar Tissue or Adhesions. When, in the course of healing, an ulcer at or near the pylorus contracts and causes the canal to become smaller, or adhesions forming in the peritoneum on contracting narrow the canal, there will come a time when increasing hypertrophy, tone and peristalsis of the stomach cannot overcome this contraction, and obstruction will then exist. In these cases the stomach will fill right down to the contractures, and is usually large, dilated, and low. A small stream can be seen trickling through the narrow area. The cap is contracted and small, and is much less tender than in the cases due to spasm and inflammation.

Some of our cases presented peculiar conditions. One patient had a large residue at both five hour and twenty-four hour examination. On liquid diet, which usually causes the patient to stop vomiting and gain weight, this patient made no improvement and was still obstructed. A tube was passed, the sinker never leaving the stomach, and the patient was given the same liquid diet through the tube. After three weeks of this treatment his obstruction disappeared and he was free from pain. In this case the deciding factor must have been physical and mental rest, because the tube treatment was given at the hospital, whereas the patient had been an ambulatory case when taking the diet. In 3 other

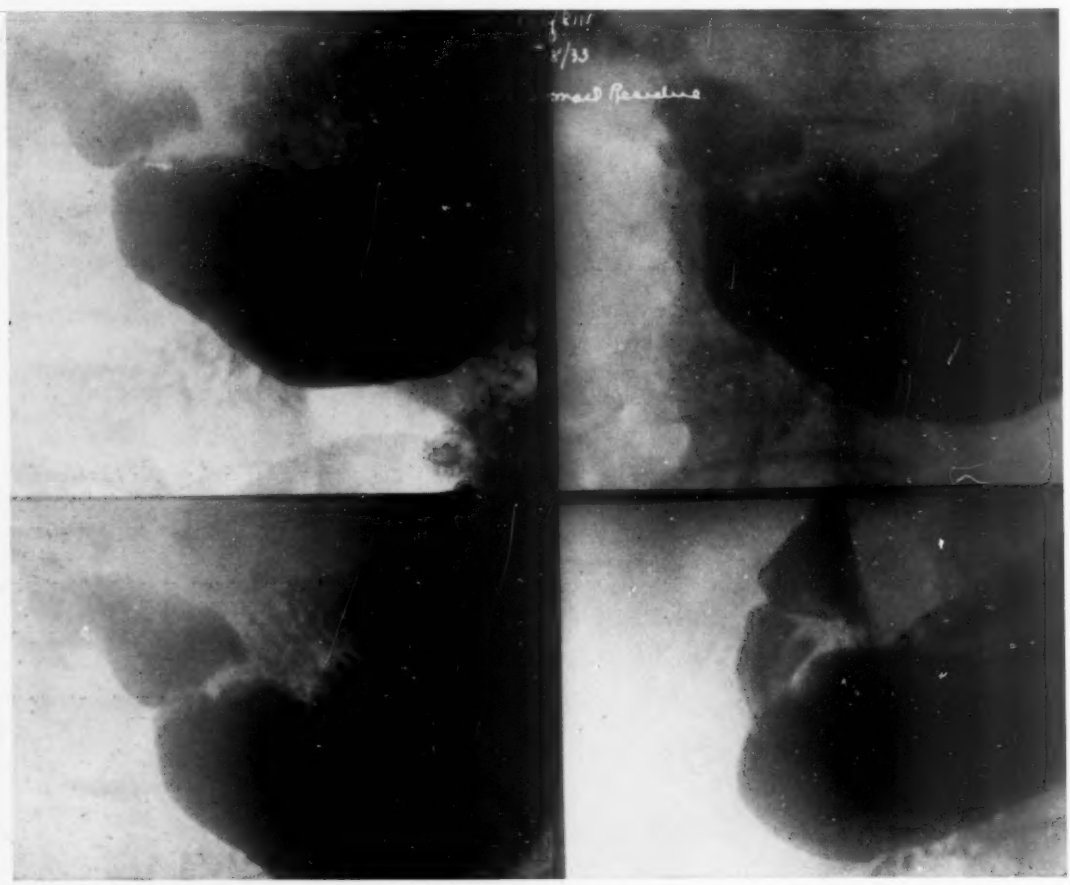

Fig. 12. H. R., 5.18.33. No roentgen evidence of duodenal ulcer. Patient has felt well since 1929. No tenderness. Ewald test meal, total acidity 36, free HCl 0, blood 0, time 45 minutes.

Fig. 13. Duodenal ulcer. Healed with disappearance of niche. Roentgen defect due to adhesions and scarring still present. T. P., 7.1.30. No prodromal symptoms, pains 1 hour p.c., four years. Tenderness over cap, 4 plus. Ewald test meal, total acidity 55, free HCl 30, time 45 minutes. Tube method of treatment and hospitalization, three weeks, ambulatory diet thereafter. Penetrating niche with corona about it at *A*.

cases the usual liquid diet with milk failed to relieve the pain and vomiting, which were relieved, however, when the patient was placed on a soft solid diet, consisting of oatmeal, rice, milk, bread.

Three of our patients have had obstruction for over three and a half years, but if they are asked how they feel, will say that they feel fine. Thus it seems that although a stomach may be obstructed to a barium meal, which is a heavy mixture, it may function in some cases with a liquid diet, and in other cases with a soft solid diet. Though there is an obstruction to barium these patients can go on apparently in good health if they adhere to a modified diet. This is one argument that medical men have against surgery in obstruction. The reverse of this is also true at times, that is, even though the stomach may not

Fig. 14. T. P., 6.1.33. Roentgenograms of cap show a persistent defect. Niche is gone. Patient has been without symptoms with exception of occasional indigestion after meals. Tenderness 0. Ewald test meal, total acidity 76, free HCl 52, blood 0, time 45 minutes.

Fig. 15. Duodenal ulcer. Healed with disappearance of duodenal defect on lesser curvature and the defect on the greater curvature still present in the form of a niche. (The niche may be lined with epithelium.) J. M., 12.2.31. No prodromal symptoms, pains 1½ hour p. c., one month. Tenderness 4 plus. Ewald test meal, total acidity 74, free HCl 63, blood 0, time 50 minutes. Tube method of treatment, and hospitalization three weeks, ambulatory diet thereafter.

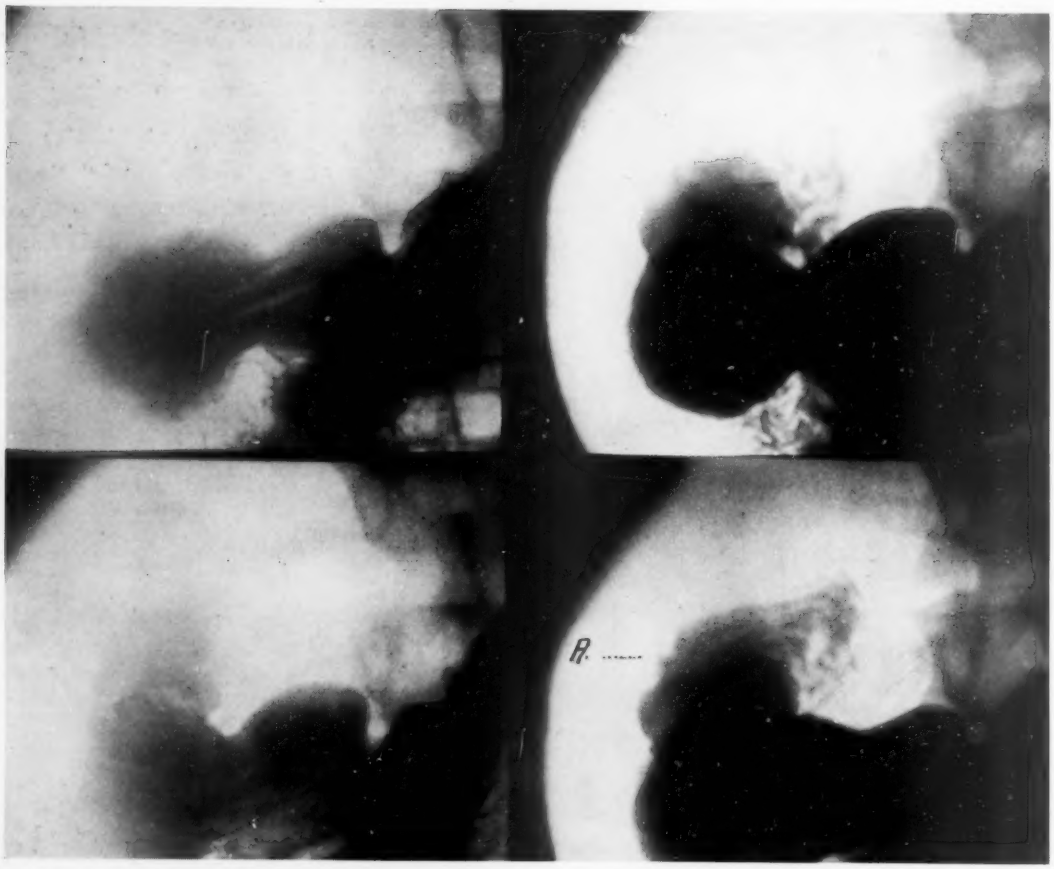

Fig. 16. J. M., 8.3.33. Niche with corona at *A*. Occasional indigestion, heart burn; no ulcer pain syndrome. Tenderness 0. Ewald test meal, total acidity 65, free HCl 40, time 50 minutes.

Fig. 17. Duodenal ulcer. Healed with disappearance of niche. Star contraction present due to converging rugae toward site of ulcer at *A*. J. W., 8.1.33. Prodromal symptoms eight years, pains 1½ hour p. c., two months. Tube method of treatment six weeks. On June 21, 1933, roentgenoscopic examination showed niche where star formation is now. Patient is symptom-free, but is still tender over duodenal area.

be obstructed to a barium meal, obstruction is shown when a stomach tube is passed. Twenty-four hours after the last meal one patient still had a pint of fluid in the stomach, with spinach eaten thirty-six hours previously.

No matter whether the obstruction is little or great, or whether it is eliminated medically, the patient with obstruction is more than a medical problem. As a matter of fact, the actual obstruction can be eliminated in the majority of cases. The patient may be freed of his spasm and the edema and inflammation about his ulcer, scar tissue obstruction may even be lessened by a non-obstructive diet, but he still has his ulcer.

It may appear that once the obstruction is dealt with, a simple ulcer remains, which should be healed by a course of medical

treatment, but our experience has not borne this out, but rather points to the fact that whether the obstruction is slight or great, the ulcer is not healed by any type of medical treatment. There follows a summary of our 27 cases of obstruction:

3 patients needed gastroenterostomy
2 patients had a perforation
1 patient had an operation for obstruction four years previously; laparotomy only was done; she still has an obstruction although the obstruction disappeared for a time
14 patients still have an obstruction, though at some time in the course of their treatment they were free from obstruction
5 patients have no obstruction but still have ulcers
1 patient, not heard of, had 90 per cent obstruction in twenty-four hours

The reason that these cases of obstruction do not heal may be due to the fact that ulcers which cause obstruction have existed longer than non-obstructive ulcers, as is shown by the following figures:

		Years
Average length of time patients with obstruction were ill before 1st roentgenogram was taken	Prodromal	4.5
	Pains	7.7
Average length of time since 1st roentgenogram was taken		2.78
Total length of time patients with obstruction were sick averaged		14.98

Cases with obstruction were therefore sick an average of 2.2 years longer than non-obstructed cases. Or it may be that these ulcers do not heal because they are situated near the pylorus, where the greatest stress and strain exists.

From this study, therefore, it is felt that obstruction is a serious accident in peptic ulcer, for which medical treatment can remove only the obstruction, and nothing more. Eventually the obstruction will return because the ulcer is not cured. Probably these cases would do better under surgical treatment. Of course, those few cases which are apparently doing well on their usual diet ought to be left alone, even though there is an obstruction to barium, which is a heavy, unnatural mixture. However, it must be remembered in operating that a stoma large enough to take

Fig. 18. Duodenal ulcer. Healed with contraction of cap but without obstruction. J. P., 10.19.33. Prodromal symptoms, five years. Pains 1 hour p. c., fifteen years. Tenderness 4 plus. Ewald test meal, total acidity 74, free HCl 66, blood 0, time 1 hour, 15 minutes. Patient has occasional indigestion. Roentgenograms and Ewald test meal show same findings as 5.10.32.

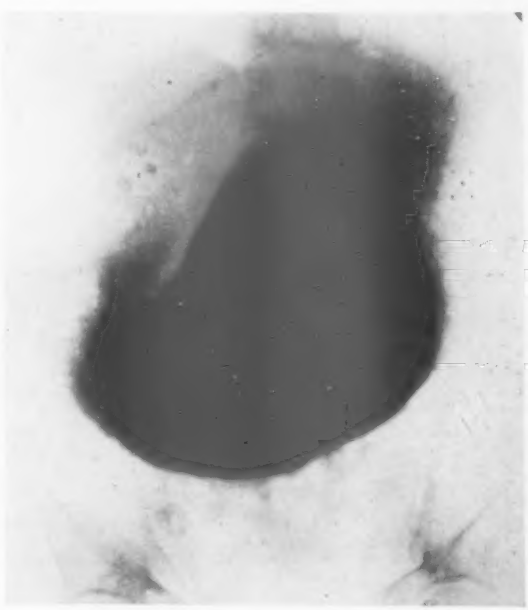

Fig. 19. Duodenal ulcer. In the process of healing and scarring it caused stenosis of the duodenum and forty-eight hour obstruction. J. S., 10.28.32. Prodromal symptoms fifteen years. Pains 1 hr. p. c., ten years. Vomiting p. c. for past six months. Tenderness slight. Ewald test meal, total acidity 80, free HCl 63, blood 0, time 50 minutes. Posterior gastroenterostomy done.

Fig. 20. Parapyloric ulcer unhealed. M. T., 5.22.33. Vomiting two years, p. c., pains six months 1 hr. p. c. Tenderness 4 plus. Ewald test meal, total amount 400 c.c., total acidity 51, free HCl 40, blood 0, time 40 minutes. Penetrating niche at *A*: 90 per cent five hour residue. Ambulatory diet.

Fig. 21. M. T., 7.11.33. Roentgenogram shows obstruction gone, yet penetrating lesion still present. Tenderness 4 plus. All our cases with this type of ulcer show great deal of twenty-four hour residue. The obstruction can be eliminated by medical treatment, yet the ulcer still remains. The penetrating lesion remains in one of our cases after four years of almost constant treatment. As soon as treatment is stopped, pain returns.

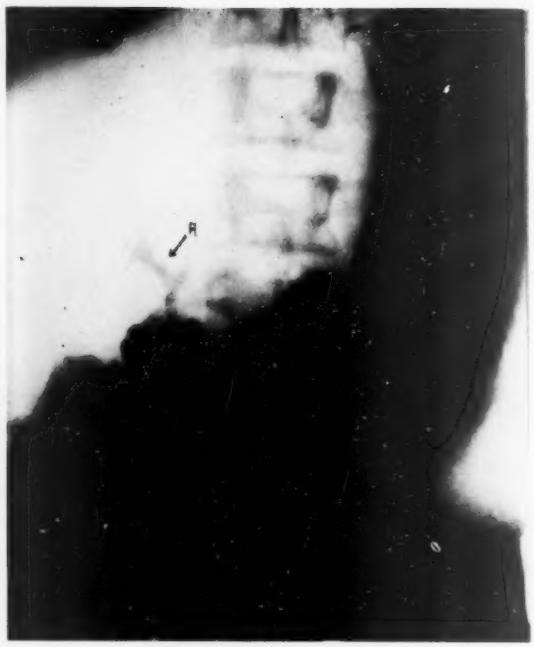

Fig. 22. Duodenal ulcer, reconstructed by surgical closure of perforation. G. B., 9.32. Pains 1 hour p. c., thirteen years. Tenderness 4 plus. Ewald test meal, total acidity 52, free HCl 41, blood 0, time 60 minutes. Roentgenogram taken before perforation shows niche at *A*. Perforation occurred on 7.26.33.

into account the contraction and retraction of the stomach when the obstruction is eliminated must be made. The stomach, which was first large, low, and dilated, now becomes small, high, and contracted, and the stoma will naturally become smaller proportionately (see Fig. 19).

Persisting Pain. When in spite of tube treatment, Sippy treatment, or ambulatory diet, the patient still has pain, is losing weight, etc., he should be operated on. It is remarkable how quickly the pain disappears after an operation. A gastroenterostomy gives immediate results in the relief of pain.

Bleeding Ulcers. Cases with serious bleeding which is causing great loss of blood should be operated on as soon as possible. If the bleeding is slight and is not lowering the blood count and hemoglobin much, medical treatment should be resorted to.

SUMMARY

1. Of 125 cases originally diagnosed from clinical, laboratory, and roentgen findings as peptic ulcer, the symptoms in 16 per cent were later found to be due to various other conditions.

2. Various factors in the etiology of peptic ulcer are discussed.

a. Majority of patients have been under nervous strain.
b. Greatest number of ulcers occur in Irish, Italian, Jewish.
c. There were 102 whites, 3 colored.
d. Ratio of men to women was 5 to 1.
e. Greatest number of cases occur in fourth decade of life.

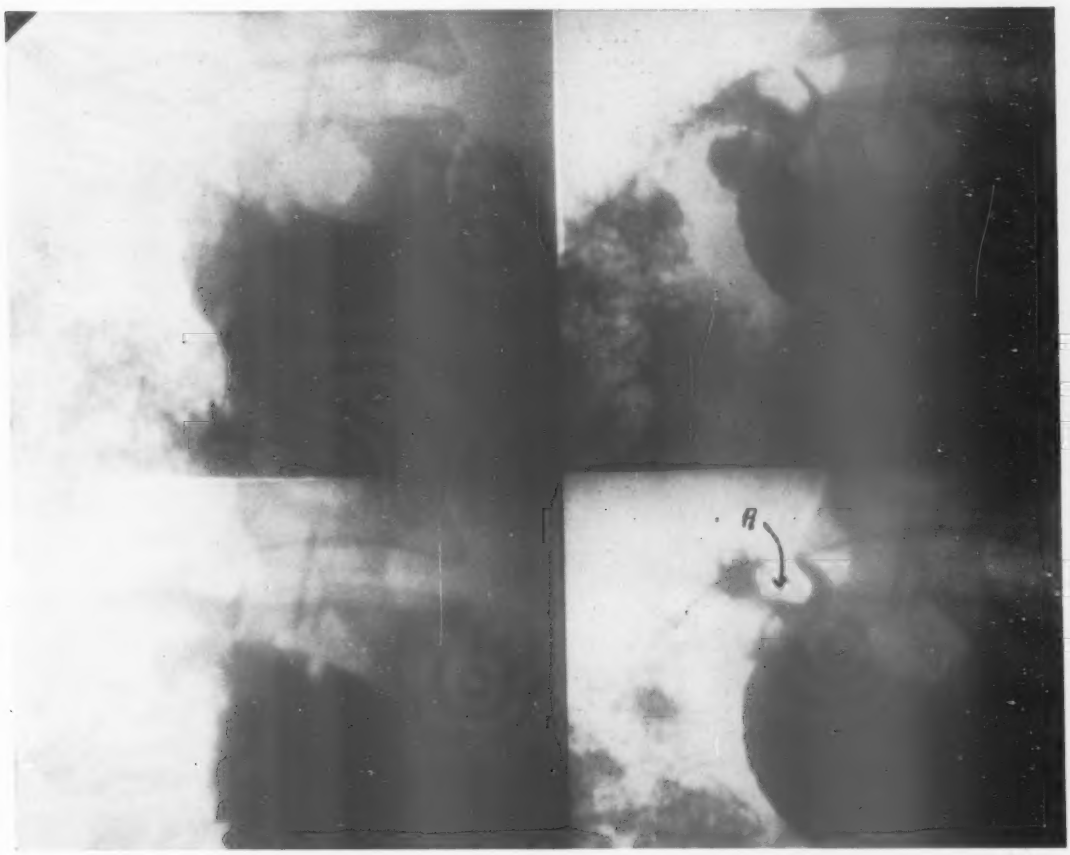

Fig. 23. G. B., 8. 10.33. Roentgenograms still show same defect with niche at *A*. Patient has occasional attacks of pain, tenderness 2 plus. Ewald test meal, total acidity 82, free HCl 62, blood 0, time 30 minutes. This case is only one of 6 perforations operated on that occurred in our series. In each case the roentgenogram showed recurrence of ulcer. Ulcer edges should be excised when a perforation is closed.

A. Hyposthenic body type was found in 86 cases. This type allows for greater acid accumulation in the stomach, and puts a strain on both the pyloric end of the stomach and duodenum, with greater strain on the latter.

B. Temperament, as affected by race, sex, age.

C. Acidity: More than half the test meals showed hyperacidity. The follow-up test meal showed a lower acidity if the patient was healed symptomatically and by roentgen ray, the acidity was slightly higher if the ulcer was shown to be dormant, and much higher in the majority of cases in which symptoms

and roentgen examinations showed active ulcer.

3. The cause of pain is discussed. Facts are given showing that increased acidity is not the cause, nor, necessarily, increased tone and peristalsis of the muscles of the stomach, unless the ulcer is attached to the muscle coat proper.

4. The average length of time ulcers had existed before the first roentgenogram was taken was 10.18 years. After the first roentgenogram was taken the average time was 2.6 years. The average total length of time symptoms existed was 12.78 years.

5. Patients who were cured symptomatically and by roentgen examination were sick a shorter time on the average than those who did not improve.

6. The younger a patient is when he develops an ulcer, the less apt he is to be cured.

7. Gastric ulcers heal readily by medical treatment.

8. Twenty-two per cent of cases on ambulatory diet had perforation, died, or required operation, whereas 2.7 per cent of patients who had the tube treatment or Sippy diet met with such accidents.

9. On the basis of symptoms alone, the percentage of cures with the tube treatment and hospitalization is 86 per cent, with the Sippy diet and hospitalization, 50 per cent, and with the ambulatory diet, 54 per cent. On the basis of improvement of symptoms, and improvement, as shown by roentgen examination, the figures are: tube treatment and hospitalization, 69 per cent, Sippy diet and hospitalization, 30 per cent, and ambulatory diet, 38 per cent. On the basis of healing shown by roentgen examination, the figures are: tube treatment and hospitalization, 39 per cent, Sippy diet and hospitalization, 20 per cent, and ambulatory diet, 23 per cent. The percentage of those who are entirely symptom-free, and whose roentgenograms show a healed lesion is: tube treatment and hospitalization, 9.3 per cent, Sippy diet and hospitalization, 0, and ambulatory diet, 5.76 per cent. These latter figures are probably too low, since they do not include many of those cases in which the ulcer is healed, but the scarring produced in healing is enough to cause symptoms.

10. Indications for surgery are accidents of peptic ulcer, such as perforating lesion, or perforations, obstruction, persistent pain unrelieved by medical treatment, repeated severe hemorrhage.

11. Perforations are discussed, as to seasonal occurrence, age incidence, and a cause for recurrence of ulcer after suture of perforation is advanced.

a. Ulcers tend to perforate two months after activation; whereas ulcers become activated in January, May, and October, perforations occur in March, August, and November.
b. Perforations lag behind the activation of ulcers when plotted in the various decades of life. The older the ulcer patient is, the more likely he is to have a perforation.
c. Methods of closure of perforations actually reconstruct the ulcer.

12. Cases with pyloric obstruction are more than a medical problem. Obstruction can be controlled, but the ulcer persists. The cause may be prolonged history, or the nature of position of the ulcer near the pylorus.

13. The stoma in gastroenterostomy must be made large enough to make up for retraction of stomach after operation.

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Vol. 34, No. 2

TUBERCULOUS CYSTS OF THE KNEE JOINT

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TUBERCULOUS cysts of the knee joint are rare. We have failed to find any description of them in the literature. The nearest approach is in the statement of Holmes and Ruggles that "Localized tuberculous pockets are also seen in the medulla near the ends of the long bones particularly in the tibia and femur. There is nothing about their appearances to distinguish them from any low grade infection. Osteo-myelitis or syphilis will present identical appearances." This statement of Holmes and Ruggles does not suggest the appearance of smooth-walled cysts adjacent to the knee joint that may have the appearance of cystic osteitis. Sundt mentions one case with a tuberculous focus in the knee joint where osteitis fibrosa had to be taken into consideration from the roentgen appearance.

True cysts of tuberculous origin have been recognized in the metacarpals, metatarsals and phalanges since Jüngling described osteitis tuberculosa multiplex cystica in 1920. These are typical smooth-walled cysts without caseation or reactive inflammation in the surrounding bone. The contents show epithelioid and lymphocytic cells but no typical tubercles or tubercle bacilli. Roentgenologically and macroscopically these cysts do not differ from the osteitis fibrosa type.

These tuberculous cysts occur only in the hands and feet in Jüngling's observations from 1911 to 1920; there are no cases of such cysts in the knee or other large joints. Van Alstyne and Gowen, in their extensive survey of the literature from 1920 to 1932, fail to find any reported cases involving the large joints. They report a case of tuberculous cysts in the shoulder and elbow but not in the knee joint. Allison and Ghormley in their survey of joint disease do not mention bone cysts adjacent to the joint as a manifestation of joint tuberculosis.

In our own observations since 1912 we have observed only the 2 cases reported here. Dr. Granat of the Vancouver General Hospital has seen one similar case with cysts of the knee joint that were proved to be of tuberculous origin.

CASE 1. (No. 23,307.) I. V. P., male, aged thirty-two. Admitted September 11, 1928. Referred by Dr. Joseph Weinberger. Previous medical history was negative. The present condition began eighteen months previously with gradual onset of swelling and pain in the right knee. There was no history of injury before the onset and there was no acute pain or other inflammatory symptom in the interval. Three days before admission he struck his right knee causing severe pain. The physical examination was negative except for the findings in the right knee. Temperature was normal. The right knee was swollen and tender with moderate restriction of motion. The roentgen examination showed multiple cysts in the upper end of the tibia with no reactive changes in the surrounding bone. There were similar cysts in the external condyle of the femur. The joint surfaces were smooth except for an excavated area about 5 mm. in diameter at the inner margin of the tibia. This was also smooth-walled and showed no evidence of erosion or bone reaction. From the clinical and roentgen findings the diagnosis of osteitis cystica fibrosa was made. The pain and tenderness disappeared with rest and the patient returned to work. During the next three and one-half years there was occasional aching and tenderness in the joint but the patient continued to work without interruption. In May, 1932, a fluctuating swelling developed over the internal tuberosity of the tibia with increasing pain and tenderness. This swelling was opened by the health insurance doctor whom he consulted at that time. The incision disclosed only a cyst and a clear yellow fluid was evacuated. The wound did not heal and drainage of clear fluid continued. On account of the continued dis-

* It is with regret that the Journal announces the recent death of Dr. Elliott.

ability the patient went to Ogden where he was observed at the Thomas D. Dee Memorial Hospital. The diagnosis of osteitis cystica was again made and roentgen therapy was advised and started. The patient returned to us in July, 1932, with the request that roentgen therapy be continued. The condition did not improve and by September the finer cyst walls had melted away but there was increasing pain, swelling and disability. This was followed by absorption of the articular surface over the central cysts of the tibia, demineralization of the adjacent bone and erosion of the joint surface. The patient was sent to the hospital in December for resection of the joint. At this time the blood picture was normal, physical examination entirely negative except for the findings in the right knee. There was no loss in weight, temperature 98.6° F., and the Wassermann reaction was negative.

Fig. 1. Case 1. Multiple cysts in the upper end of the tibia and external condyle of the femur. The bitten out area at the inner margin of the tibia was also proved to be a smooth-walled cyst and contained clear fluid. This film was taken August 11, 1932, five years after onset. The findings in our films September 11, 1928, are practically identical.

Operation by Dr. M. C. Harding, December 16, 1932. The upper 3 cm. of the tibia was resected and the adjacent portion of femur removed to give broad apposition. The joint at this time showed typical tuberculous granulation tissue, with the presence of caseation and tubercle formation. The cysts that had not broken into the joint showed a gray homogeneous substance of the consistency of an egg custard. The walls were smooth without evidence of caseation or bone necrosis and a membranous lining was peeled away leaving a firm wall of smooth eburnated bone.

Comment. This case is of over five and one-half years' duration, in which time the patient worked about five years. At the observation eighteen months after the onset there was no erosion of the joint surface, no demineralization of the adjacent bone and no evidence of marginal erosion except at the inner margin of the articular surface of the tibia, and this was proved by later incision to be a smooth-walled cyst. There was no evidence of tuberculosis of the knee until after this cyst was opened and drained. The multiple cysts adjacent to the knee had the appearance both at the roentgen examination and macroscopically of an osteitis fibrosa cystica.

Case II. (No. 10833.) N. S., aged thirty-nine. Admitted June 5, 1924. The medical history was negative except for an appendix operation several years previously. The present condition followed an injury to the right knee four years ago. There was a gradual onset of pain, swelling and cracking in the knee joint. The swelling and slight restriction of motion slowly increased. Severe pain and marked swelling were of only a few weeks' duration. The physical examination was entirely negative except for the appendix scar and the condition in the right knee. This knee showed a hard large swelling of the joint with no heat and no tend-

erness. The motion was limited from 165° in extension to 100° in flexion. The blood picture was normal and the Wassermann reaction negative. Urine examination was negative. Temperature 98.8° F. The roentgen examination shows thickening of the soft structures and calcareous deposits in the alar ligament. There is a cyst in the patella about 2.5 cm. in diameter. The joint surfaces are smooth. There are two circumscribed translucent areas about 3 cm. in diameter in the upper end of the tibia

In December, 1924, the knee was again struck a hard blow which was followed by prompt swelling over the internal tuberosity of the tibia. An incision over the swelling evacuated mucopus and the healing was again prompt. In April, 1925, the cyst of the tibia ruptured into the knee joint with severe acute inflammatory symptoms. The joint was resected at this time and a microscopic diagnosis of tuberculosis was obtained. After recovery from the resection she had a 6 foot fall in 1925

Figs. 2 and 3. Case II. Cysts in the patella and upper end of the tibia. Four years after onset. The cyst of the patella is ruptured into the joint at the lower margin.

that are probably cysts. A diagnosis was made of ruptured cysts in the patella or tibia.

Operation by Dr. M. C. Harding, June 8, 1924. Split patellar incision. The patella contained a cyst three-quarters of an inch in diameter filled with a grayish-yellow, structureless, custard-like material. The cyst had ruptured into the knee joint and there was marked inflammation beneath the fat pad. The joint surfaces of the femur and tibia were normal. The cyst was curetted and the inflamed fat pad removed. The patient made a prompt recovery.

and fractured the knee through the operated area. Amputation at this time resulted in complete recovery.

Comment. This case was of four years' duration prior to surgery. The cysts in the patella, tibia and femur presented firm smooth walls and there was no evidence in the roentgenograms or macroscopically in the joint pointing to tuberculosis. The contents of the cysts was typically that of an osteitis cystica.

The following case of a non-tuberculous

cyst in the patella with similar appearance is presented as a contrast to the above two proved cases of tuberculosis:

Case III. (No. 23186.) W. M. A., male, aged forty-one. Admitted August 27, 1928. Medical history was negative aside from a slight inguinal hernia of twenty years' duration. In the summer of 1924 the left patella was bitten by a hog. The wound was infected but healed without sequelae. The patient has worked continuously without symptoms in the knee until three weeks ago. At that time the knee was severely strained in lifting. This was followed during the night by severe pain and swelling. The joint became stiff and sharp pain has continued since. Physical examination was negative aside from the inguinal hernia and the condition in the left knee. There was marked swelling in the suprapatellar pouch but this swelling was not tender or hot. The patella was nodular and very tender. Motion was restricted from 170° in extension to 90° in flexion. The roentgen examination showed multilocular cysts in the patella but there was no other roentgen evidence of pathology in the joint. The diagnosis was made of ruptured patellar cyst.

Fig. 4. Case III. Multiple cysts of the patella (non-tuberculous). The cyst at the lower margin of the articular surface is ruptured.

Operation, Dr. M. C. Harding, September 7, 1928. Split patellar incision. The cysts in the patella contained a muco-custard-like substance. A mass of inflammatory tissue extended from the patella to the femur. Otherwise the articular surfaces were normal. The cyst was curetted, the inflammatory tissue removed and the joint closed. Recovery was prompt following the surgery.

Comment. This case is now about five years in duration and has showed no evidence of tuberculosis and yet from roentgen and macroscopic appearance the cyst in the patella did not differ from the cysts in the two previous cases.

The diagnosis of tuberculosis of the knee joint is frequently a difficult problem. With all the evidence at hand, history, clinical findings, roentgenograms, tuberculin reaction and guinea pig tests, a preoperative diagnosis is often impossible. Smith reports 63 cases of chronic joint disease suspected of being tuberculosis which came to operation and found that in 39.7 per cent tuberculosis was not present. Sundt, in 61 cases operated on for probable tuberculosis of the knee joint, found that 48.4 per cent were non-tuberculous. From the roentgen standpoint the diagnosis is even more difficult and frequently impossible. Sundt makes the positive statement that "There exists no roentgen picture that is entirely typical of joint tuberculosis in any of its stages."

It is an accepted fact that tuberculosis of the knee joint may be present with entirely negative roentgen findings. On the other hand, all of the usual findings

characteristic of typical joint tuberculosis may occur in non-tuberculous lesions. The diffuse demineralization of the adjacent bone may be present in any inflammatory lesion that involves the synovial membrane and may be as great as that seen in advanced tuberculosis. The marginal erosion described by Fraser, which represents the early invasion of bone at the synovial reflexion, has also been shown by Allison and Ghormley to occur in cases of proliferative arthritis. The subchondral infiltration described by Phemister frequently does not alter the visualized joint margin until late in the disease and even then the roentgen findings may not differ from those of a chronic osteoarthritis of other origin. Invasion and bone destruction of the epiphysis may present findings not distinguishable from syphilis or other joint infections.

The smooth-walled cysts simulating osteitis fibrosa cystica must also be considered a definite manifestation of joint tuberculosis. The two cases presented here show that such tuberculous cysts occur in the knee joint as well as in the hands and feet as described by Jüngling and in the shoulder and elbow as described by Van Alstyne and Gowen. However, these cysts are not pathognomonic of tuberculosis and there may be no definite roentgen findings to differentiate them from true osteitis fibrosa cystica. If should be remembered that cysts occurring in the knee joint may be tuberculous in origin and the discovery of such cysts in a chronic gonitis should indicate an early biopsy to establish the diagnosis.

I wish to thank Dr. Maynard C. Harding for permission to report these three cases which we have studied and followed together.

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ROENTGEN THERAPY IN HYPERPLASTIC BLOOD DYSCRASIAS

NEW TECHNIQUE FOR MYELOID AND LYMPHATIC LEUCEMIA, POLYCYTHEMIA RUBRA VERA AND HODGKIN'S DISEASE*

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THE effect of irradiation on the vegetative nervous system, which was demonstrated in animal experiments in 1923 for the first time (Langer), has been corroborated by many other investigators. The reaction of a treated sympathetic nerve to irradiation with a slight stimulation (Stage I), which passes then to a paralyzing effect of the treated nerve (Stage II), has now been observed and described by other writers, mostly of the French School. Most roentgen therapists are so convinced that the effect of irradiation is exclusively a local one at the place of absorption (demonstrated by physicists and biologists repeatedly) that any attempt to show a distant effect of irradiation in addition to this direct effect will encounter skepticism. Since my publication in 1927, written with the view of being an incentive to other workers to do further research, very little response has been observed. May I again, therefore, present a paper which may show the importance of bringing research into the study of the effect of roentgen rays on the vegetative nervous system.

To illustrate this point I will discuss results of this method of treating the leucemias, polycythemia and Hodgkin's disease. There are three leading hypotheses concerning the etiology of the leucemias: the first is the infectious theory, that is, the leucemic state which represents a reaction of the leucopoietic organs to an infection. No one knows how such infection can produce a stage of bone marrow or lymph gland activity of this character. Since roentgen rays have little or no effect upon a pathogenic organism, this theory is not generally accepted by roentgenologists. The second theory, brought forward first by Hoffman, Banti, and still supported by Piney, Ewing, and others, is that the leucemias are of a neoplastic origin. If it is a neoplasm then we might ask with Horder, a neoplasm of what? Furthermore, granted that leucemia belongs to the group of neoplastic diseases—what are the agencies needed to produce such neoplastic tissue formation? As a third theory one asks if it is produced by hormone disturbances as stated by Nägeli. Oswald has shown in an elaborate discussion concerning the hormone theories that no glands of internal secretion, however greatly disturbed, have ever shown a blood picture which might even resemble leucemia.

Horder thinks that neurotrophic centers might be stimulated, but, unfortunately, seems to regard this as a very vague hypothesis. Since Senn's first publication everyone experienced in the irradiation of leucemias and related diseases may have been concerned about the final result of such treatment. Minot's elaborate publication made the confusion still greater. It has been shown that roentgen irradiation is the treatment of choice for the leucemias. That old French master, Belot (cited by Palmieri) said: "If you refuse a leucemia patient the benefit of x-ray, you assume the same responsibility as the doctor who refuses mercury to a syphilitic." However, even the best roentgen treatment does not give a great deal of satisfaction.

Eight years ago with the old standard technique, when patients often failed to return, I began a new approach to this subject. The irradiation over the spleen as used by Senn, I felt had no scientifically proved background and should therefore be dis-

* Read at the Thirty-Fifth Annual Meeting. American Roentgen Ray Society, Pittsburgh, Pa., Sept. 25–28, 1934.

carded. If the enlarged spleen is the cause of the disease the surgical removal of this organ, as carried out at the Mayo Clinic and by others, would be a better procedure, but they have reported failure. Giles states that radium or roentgen treatment causes replacement with connective tissue so that the spleen develops a resistance to irradiation and finally radiotherapy becomes entirely ineffective. Jenkinson stated recently, "Destroying the spleen by irradiation will, in a measure, destroy a very important agent in the successful treatment, namely destruction of white cells."

As we saw at the post mortems of our earlier roentgenologists, irradiation of the long bones will, unfortunately, eventually produce irreparable paralysis of the blood producing marrow and, therefore, I felt this could not be the right approach. Haphazard treatment of the lymph glands hastened the course of the disease. Only a study of the leucemias would aid in approaching the treatment of such diseases from another angle.

Comparison between polycythemia vera and leucemia shows that in both cases the marrow of the bones is in a stage of overactivity. Polyglobulia presents the erythroblastic portion of the parenchymatous marrow in a state of irritation. In leucemia the leucoblastic portion shows hyperplasia which is identical with hyperfunction.

It will be of interest to note the observations of several workers regarding the interrelationship between polycythemia rubra vera and myelogenous leucemia. Nägeli believes that there is an initial polycythemia in the early stages of myelogenous leucemia. He also observed myelogenous leucemia changing into true polycythemia. Pendergrass and Pancoast, Minot and Buckman, Harrop and Hörstrup, Klumpp and Hertig, in reviewing the literature and from their own observations, consider the significance of the composite picture of polycythemia and myelogenous leucemia. McAlpin reports a case of polycythemia which, during two years of observation, slowly changed into a leucemia. A similar observation was made by Koehler who believes that the degree of irritation by toxins produces different blood pictures. Rosenblum and Krimer, after a pathological study of a previous clinically observed case, came to the conclusion that leucemia as well as polycythemia must be regarded as produced by the same irritants (toxins). Minot and Buckman believe there is a close relationship between these diseases. Hörstrup cites 7 cases collected by Weil in which roentgen therapy over the spleen transformed polycythemia vera into leucemia.

Wiseman gives an excellent description of the lymphocytes and his technique of studying these cell elements in lymphatic leucemia, along with Downey's article, should be consulted in every case. Wiseman states that "the lymphocytes comprise a specific strain of cells which arise in the lymphatic tissue and which normally mature with an orderly sequence of changes similar in character to those observed in the other blood cells. In leucemia, whatever its nature, the changes become uncontrolled and result in a disorderly overproduction and delivery of lymphocytes. Prognosis and treatment are determined largely by a study of the percentage of young lymphocytes found in the peripheral blood."

Again two theories concerning the etiology of lymphatic leucemia are considered: (1) infectious nature, (2) neoplastic nature. Banti placed the lymphatic leucemias directly in the group of sarcomata. Piney considers all forms of leucemia as neoplastic. Ewing classifies the acute form as infectious, and regards the chronic form as essentially neoplastic, but has to admit that the clinical course of the disease shows a constant irritation of toxic or bacterial origin. The observation that irradiation has little or no effect on toxins or bacteria makes this theory unworkable for the roentgen therapist in view of the beneficial results observed by roentgen therapy. Webster believes that lymphosarcoma, lymphatic leucemia and leucosarcoma are different manifestations of the same dis-

ease. Webster says: "This disease is not a neoplasm but is a direct response on the part of lymphocytes to a chemotactic influence evoked by the disease-causing agent. The presence of this substance in any tissue or organ produces there a local accumulation of lymphoid cells." As lymphatic leucemia, pseudoleucemia and lymphosarcoma show the same degree of radiosensitivity, and as the tumors disappear at an equal rate following roentgen exposure, Evans and Leucutia believe that this group is of the same neoplastic nature—in other words, they should have the same etiology and pathogenesis.

The nature of the disease, its local manifestations and mode of spread, are not at all comparable to a malignant tumor with its metastases, but simulate more closely the progress of an infectious disease.

How then can we explain the beneficial effect of irradiation in the leucemias and polycythemias? If it is not the effect on a toxin or bacteria, or on the glands of internal secretion, the logical conclusion would seem to be that it is a direct one. This point of view is emphasized by Desjardins who gives a complete list of the investigators who thought they had proved conclusively that the lymphocytes in the circulating blood are equally sensitive to irradiation, and are also destroyed in large numbers by exposure to roentgen rays or radium. Giles states that "the effect on the blood obtained is in proportion to the number of square centimeters of skin surface irradiated and upon the size, intensity and character of the dose." Arendt and Gloor, of Nägeli's clinic, expressed the same point of view, namely, that the entire radiation therapy is a local one affecting the tissues exclusively at the place of absorption.

This point of view cannot be accepted without further examination. Ewing and Milani cite Jolly and Lacassagne who were not able to demonstrate any changes in the radioresistance of the leucocytes after irradiation *in vitro*. Ewing states "that animal tissues are very complex and that their reactions depend not merely upon changes in the predominating cell, but upon the integrity of blood and lymph circulation, nerve supply, and other intracellular relations constituting the environment." Piney is of a similar opinion. Milani says, "It is difficult to imagine that only destruction can bring about equilibrium in the blood. It is necessary to think that x-rays inhibit at the same time the hyperfunction of the bone marrow, or at least neutralize those factors which are augmented by the abnormal proliferation. It is clear that the fundamental action must be an indirect effect from a distant place." Milani's effort to explain the effect of roentgen irradiation in leucemia shows clearly how difficult it is for roentgenologists to come to a satisfactory understanding.

THE NEW ASPECT

In this confusion in which none of the theories explain satisfactorily many of the results which have been obtained, our attention may be directed to the rôle which the vegetative nervous system might play in the leucemias and related diseases.

The well-known use of arsenic called by Forkner "another tool which may add to our notoriously poor armamentarium for the palliative treatment of leukemia" may paralyze the sympathetic nerve fibers, at least to a certain extent. This should be fully investigated since continuous doses apparently lead to a paralysis of the bone marrow which is then unable to produce either leucocytes or erythrocytes.

CLINICAL SYMPTOMS

In the systematic picture of the leucemias and related diseases there are also many signs of irritation of the vegetative nervous system. I need only mention general nervousness, irritability and restlessness. Many investigators found the basal metabolism increased in the leucemias. Friedgood mentions bilateral exophthalmos as indicative of a hyperactive sympathetic nervous system and points out the similarity of exophthalmic goiter and

chronic lymphatic leucemia both of which are characterized by an elevated basal metabolism. Schlossmann has shown that in lymphatic leucemia the increase of basal metabolism, reported from many observations, was not produced by the leucocytic cell metabolism. Baldridge and Barer found that the increased number of leucocytes and increased activity of the hematopoietic tissues are entirely inadequate as explanations of the increased oxygen consumption in leucemia. Minot and Buckman, and Martin found an increased basal metabolism in all of their cases of polycythemia vera. Menard found that the basal metabolism rises before the leucocytes increase in number.* The typical disease which always shows increase of basal metabolism is of course thyrotoxicosis.

Another infrequent symptom observed in leucemias of possible importance in this connection is symmetrical pain in the joints. That symmetrical pain in the joints and bones can be correlated with an overirritated sympathetic system has been expressed by the writer in other publications.

Although it is doubted by some authors that the sympathetic nerve irritation plays a rôle in herpes zoster, it should be mentioned that Katz found 10 cases of this symptom in 22 cases of leucemia. It is more frequently observed in Hodgkin's disease as described by Pancoast and Pendergrass. Van Harlingen believes that herpes is a result of inflammatory changes of the posterior root ganglia which in turn irritates its corresponding nerve element.

Also the fact that these diseases present a stage of hyperactivity in cell production suggests that an overirritation of the vegetative nervous system might be responsible for this disorder. If, as these considerations so strongly suggest, the vegetative nervous system is important in these conditions, roentgen treatment of them, especially as related to the vegetative nervous system as presented above, affords a primary field of investigation.

* In a previous publication I have attempted to connect the beneficial effect of roentgen rays with their effect on the vegetative nervous system in thyrotoxicosis. Recently Rosselet has come to the same conclusion. The most important contribution, by Sunder-Plassmann, shows histopathologically the neuroregulation of the human thyroid gland and the central genesis of the thyrotoxicosis, and this should be known to every roentgen therapist. Increased basal metabolism can now be connected with an overirritation of the sympathetic nervous system.

THE INFLUENCE OF THE VEGETATIVE NERVOUS SYSTEM ON THE BLOOD AND THE EFFECTS OF IRRADIATING THIS SYSTEM

The question arises whether the reason for the beneficial effect of irradiation—other than the standard one used in leucemia and related diseases—is the influence of irradiation on the vegetative nervous system. This will explain, at the same time, the mode of action for an empirically found beneficial result which so far has been lacking.

Let us take up some of the results of other workers on the effect on the blood of the vegetative nervous system. Then let us consider the influence of irradiation on the vegetative nervous system and see if the results observed may not be due to the secondary effect of the rays, i.e., quieting an overirritated vegetative nervous system.

Leschke believes that a vegetative nervous center regulates the blood producing organs. He cites Rosenow who could show that an artificial lesion of the vegetative nervous center could produce leucocytosis.

Schulhof and Matthies could produce polyglobulia by a lesion of the proximal part of the vegetative centers of the brain of rabbits. This would indicate that the brain plays a rôle in the regulation of the number of circulating erythrocytes. They state that nothing is known about the vegetative centers of the brain in polycythemia and other diseases of the hematopoietic organs.

Bernhardt treated 5 cases of leucemia with sunlight. Exposure of 50–100 sunhours over a period of several months was followed by improvement in general health, diminution of the size of the spleen and decrease of leucocytes. Nägeli reports also

beneficial results from such treatment. Besides, the other well-known factor which might benefit the patient with such treatment is the effect of ultraviolet on the endfibers of the sympathetics. Rothmann and others believe that ultraviolet rays paralyze the endfibers of these nerves. The beneficial effect might be explained by a reflex through the ganglia and vegetative nervous center.

Hoff and Glaser have made an attempt to show the vegetative regulation of the blood. Eckel found that grenz irradiation of the rabbit's leg produces a marked decrease in the number of leucocytes, while, if a sympathectomy was previously performed on such a leg, no decrease was observed.

Milani and others noted an immediate increase of lymphocytes or leucocytes following irradiation in leucemia patients. This increase corresponds to what I have called Stage I. In this case the irradiated overirritated sympathetic will, for a short while, enter a higher stage of overirritation before Stage II (decrease of nerve irritation, and consequently blood count) can be observed.

Jenkinson treats his leucemia patients over the chest, irradiating the sternum. He reports a case which did not respond to treatment over the spleen or long bones. Treatment over the chest brought about the beneficial result observed. He explains that this technique which gives, in his opinion, the best results is aimed at the sternum, which is rich in blood producing marrow, as well as on the circulating blood, since the heart and aorta are in the path of the rays. In my opinion the great chain of paradorsal ganglia are affected and consequently the reduction in white blood cells is observed.

The spontaneous disappearance of remote tumefactions in lymphatic leucemia after irradiating limited regions of the lymph glands, or treating the spleen with a small amount of radiation, has been observed by Evans and Leucutia and many others. I explain this as a reflex action of a partly quieted down vegetative nervous system by roentgen radiation. Thus roentgen rays produce a beneficial distant effect.

TELEROENTGEN THERAPY

The technique of treating the entire body with roentgen rays in the form of teleroentgen therapy was first introduced by Teschendorf for treating leucemias and related diseases. The most beneficial results were observed in patients who had the most severe reactions following irradiation —undoubtedly an effect of roentgen rays on the vegetative nervous system. His best results after such treatment were observed in leucemia and lymphogranulomatosis. Dale, using the same technique, theorized that by covering the entire body with radiation the organ or organs primarily at fault in leucemia must be influenced. Mallet and Pulsford, using a similar technique, specifically point out the great radiosensitivity in leucemia cases, which were previously treated over the spleen and long bones and found finally to be radioresistant. Sluys reports good results with this technique and Heublein continuously irradiating the entire body observed beneficial effects in the leucemias and lymphoma. Since they have obtained such remarkable results in lymphogranulomatosis by irradiating the entire body, it is probable that the roentgen rays may have a similar effect on the organ which is out of balance in leucemia. Chaoul and Lange, treating practically the entire body with large fields and small doses, in lymphogranulomatosis, reported excellent results. Gilbert who gives the most elaborate report on roentgen therapy in Hodgkin's disease, advises extensive irradiation of not only the visible and palpable tumor masses, but also areas which have as yet not been affected by the disease. The fields outlined in his charts cover practically the entire ganglia of the vegetative nervous system (Fig. 1). His results are excellent. As pathologists have reported the combination of Hodgkin's disease and lymphatic leucemia with typi-

cal signs of hyperplastic bone marrow, and since McCartney has found in the same patient typical pictures of Hodgkin's lymphoid leucemia and myeloid leucemia, might it not be possible that all three of these diseases are caused by the same irritation? Such irritation in my opinion is to be sought in the vegetative nervous system. The roentgen treatment over the vegetative nervous center and ganglia with small fields instead of using teleroentgen therapy is certainly less complicated.

The effect of roentgen irradiation in leucemias over the spleen or long bones cannot bring the desired prolonged results, as the center of the vegetative nervous system and the higher situated ganglia are still in a state of overirritation.

With this idea in mind I started to treat the patient first over the center of the vegetative nervous system, and gradually descended to the lower centers. With such a sensitive organ as the vegetative nervous system it took time, as will be seen and with certain lucky coincidences, until a satisfactory technique and dosage could be worked out.

It is not the purpose of this paper to report statistical material, but merely to point out the effect of irradiation over the vegetative nervous center and ganglia, and to suggest that the vegetative nervous system seems to play a very important rôle in the production of leucemias and related diseases.

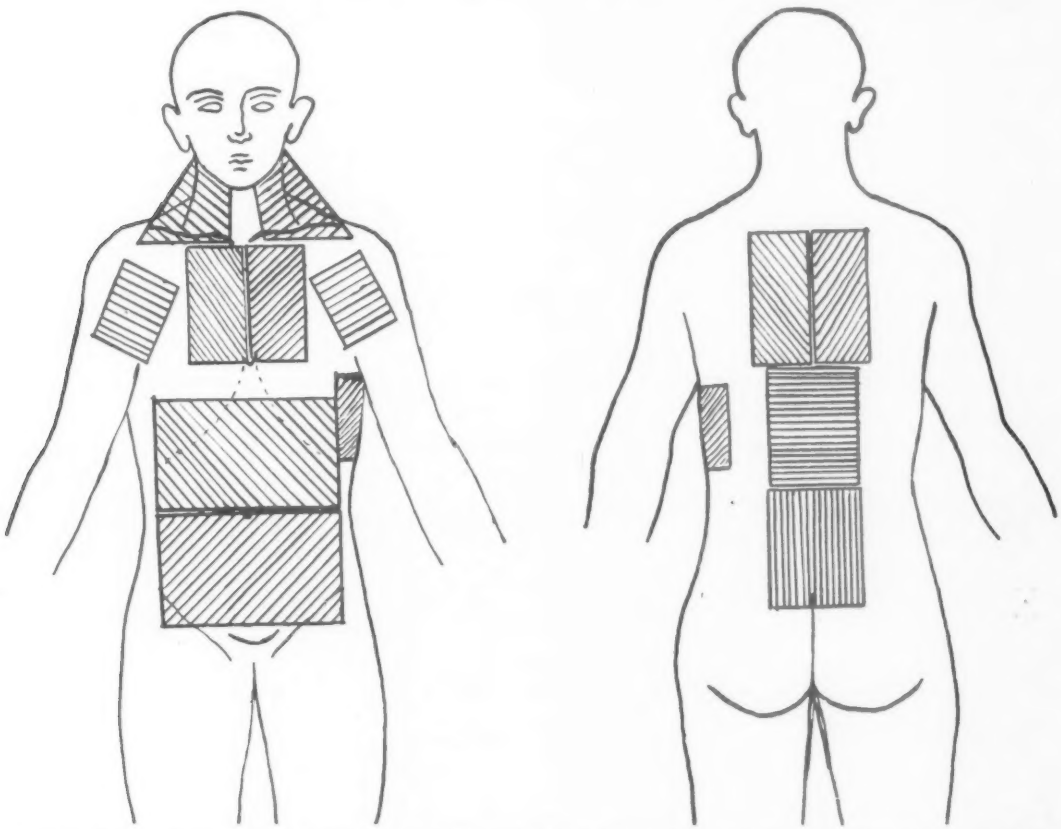

Fig. 1. Reproduced from the article by Gilbert and Babaïantz[23] with the permission of the authors.

TECHNIQUE AND CASE REPORTS

Treatment over the center of the vegetative nervous system and over the sympathetic ganglia of healthy individuals with a small amount of radiation (250 r each field) has been carried out, but not thoroughly enough to permit final conclusions. It might be stated that a slight rise

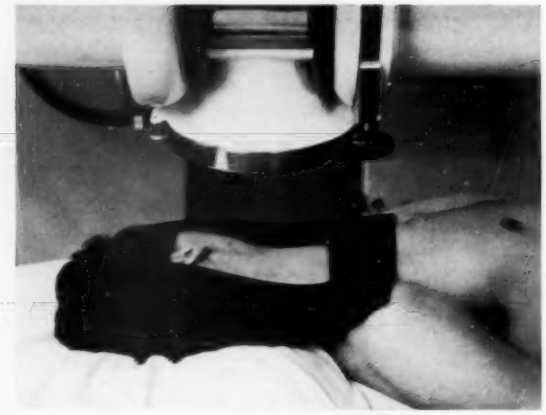

Fig. 2

of leucocytes, followed by a fall below the figures obtained before irradiation, can be observed. Lymphocytes also in general show a slight rise, followed by a distinct fall below the initial figures.

The difficulty in evaluating such treatment on the effect of roentgen rays on the blood lies in the fact that so far only a few persons have been found who seemed to have a perfectly balanced vegetative nervous system. The data to be had following such treatments should present an interesting as well as fertile field of research for the clinician and roentgenologist.

The fields for treatment over the vegetative nervous system—including the centrum—are the following: with the head of the patient turned so that the neck and temporal region are in the same plane—a field is outlined to include the hypothalamus and wall of the third ventricle (diencephalon) and the three cervical sympathetic ganglia (Fig. 2). With the patient in the described position the portal of entrance is through the subtemporal region and the side of the neck. The size of this field is usually about 7×18 cm. The second two fields are so arranged that the line of the processus spinosi of the first to seventh dorsal vertebra are the dividing line of two fields, each of which are 7 cm. wide and approximately 18 cm. long. The inclination of the tube is about 25° directed toward the opposite side of the patient so that the central ray aims at the

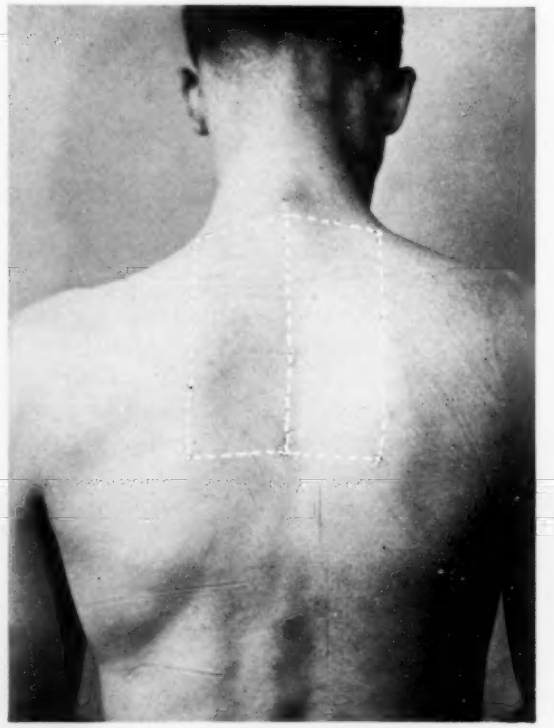

Fig. 3

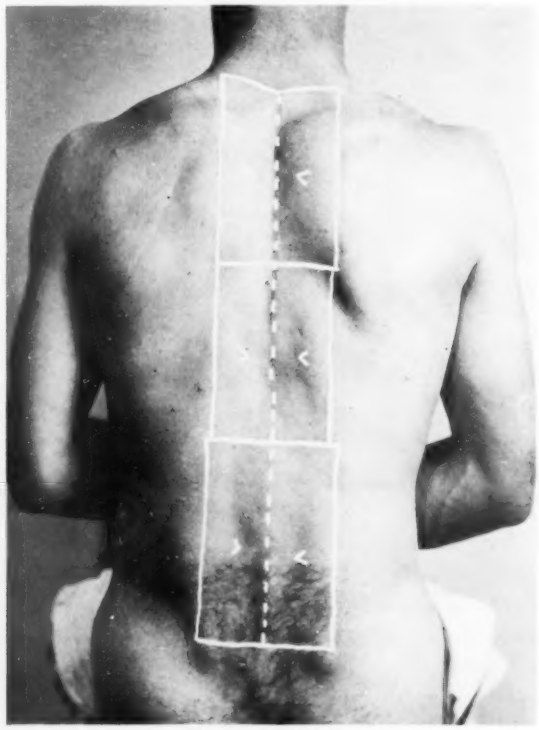

Fig. 4

paradorsal ganglia and vegetative nerve fibers of this region (Figs. 3 and 4). The third two fields are from the seventh dorsal to the second lumbar processus spinosi and the inclination of the tube and size of the fields are the same. The fourth two fields are from the second lumbar to the sacral region but the fields are each about 3 cm. wider and the angle of tube inclination to the opposite side is reduced to about 15° on account of the anatomic spreading of the paravertebral trunks and ganglia in this area.

Dosage. Although the dosage seems to be of the greatest importance and needs still further study, I believe it will be more instructive to present cases treated exclusively over the vegetative nervous center and ganglia, using different doses to evaluate the reaction of such treatment, and to point out the mistakes we certainly made.

Myeloid Leucemia. Patient, Mrs. M. M., aged thirty-five. First seen in our department in November, 1931, after having previously received roentgen treatment over the spleen at another hospital. The patient and the referring doctor stated that she grew worse after roentgen irradiation over the spleen. The spleen on admission was extremely large and reached. McBurney's point. The weight of the patient was 114 pounds. She was so weak that a basal metabolism was not advisable, and the general condition gave the impression of a very advanced case. The blood count (Table 1) at the time of admission was: red blood cells, 3,460,000; white blood cells, 99,500; Hb, 49 per cent; polymorphonuclears, 30 per cent; small lymphocytes, 2 per cent; eosinophiles, 5 per cent; myelocytes, 63 per cent. On account of the severity of the case the roentgen doses over each side of the neck were only 150 r.

TABLE I

M. M. AGE 35. ADMISSION: NOVEMBER 16, 1931. DIAGNOSIS: MYELOGENOUS LEUCEMIA

R.B.C.	Hgb.	W.B.C.	Polys.	Sm. L.	L. L.	Eos.	Trans.	Myelocytes
Blood Count Before X-Ray Application Over Vegetative Nervous System								
3,460,000	49	99,500	30	2		5		63
Blood Count a Day After X-Ray Application Left and Right Side of Neck 150 r Each Side								
3,400,000	65	120,000	44	6	1	2	2	44
Blood Count Ten Days Later, After Treatment of Entire Spine 300 r Each Field								
4,000,000	80	84,000	44	8	2		3	43
Blood Count Eight Days Later, After Repetition of Radiation Over Entire Spine 600 r (Total) Each Field								
4,200,000	85	25,000	63	7	1	2	2	25
Blood Count on January 12, 1932								
4,200,000	85	10,000	60	18	6		6	10
Blood Count on February 9, 1932								
4,400,000	85	30,000	54	8	2		6	30
Blood Count on February 19, 1932 Over Entire Spine 600 r (Total) Each Field								
4,250,000	85	12,400	65	8	2		4	21
Blood Count on March 11, 1933								
4,400,000	90	7,900	70	20	2	1	3	4

A blood count taken the day after these two fields were given showed a Stage 1 reaction (increased irritation of the vegetative nerves after roentgen irradiation with an increase of leucocytes). (See also Milani's observation.) Instead of being satisfied with this reaction we gave another 150 r over each side of the neck and two days later repeated the treatment with 200r.

A blood count was not made until ten days later when the patient had received 300 r over each paravertebral field of from the 1st to the 7th dorsal vertebra. We had given 150 r over each field on two successive days. The 8th dorsal to the 3d lumbar paravertebral fields then also received 300 r. At this time the blood count showed a drop in the white blood cells from 120,000 to 84,000, but the myelocytes remained practically the same. Because of this apparently poor result additional paravertebral roentgen application of 150 r over each field from the 1st dorsal to the 3d lumbar vertebra was repeated until each field had received a total of 600 r. This time the blood count showed a satisfactory reaction since the white cells had dropped to 25,000 and myelocytes from 45 per cent to 25 per cent. On January 12, 1932, the patient's blood count was as noted in Table 1 Consequently no further treatment was given. After one month the patient again did not feel so well, and showed a distinct increase in the white blood cells and myelocytes. Immediately paravertebral roentgen irradiation, 150 r, each field, up to 600 r, each field, was given, and the blood counts taken one and two months later were found to be practically normal. We irradiated the patient paravertebrally at various times until March, 1934. During this time she did her own housework, and feels well today after three years of observation and treatment. The spleen has reduced in size but is still palpable two finger breadths below the costal margin. Her weight today is 138 pounds. The basal metabolic rate is minus 2. Today I consider that this case was overdosed from the beginning; however, the effect of roentgen irradiation over the vegetative nervous system can be demonstrated by the blood counts (Fig. 5).

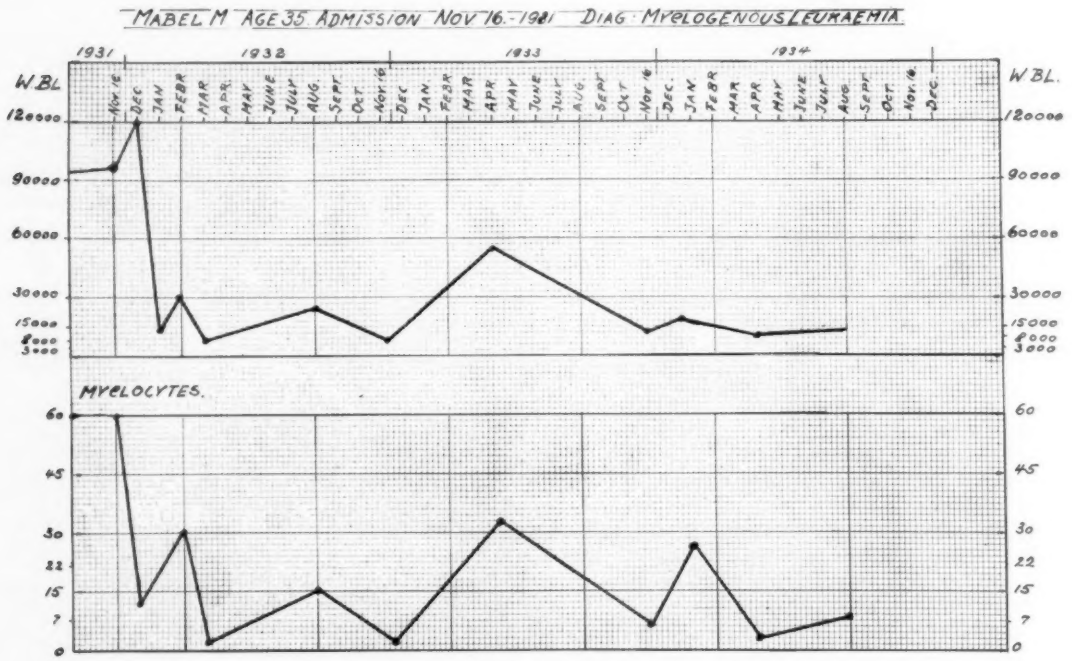

Fig. 5

A better technique in my opinion was used in another case of myelogenous leucemia which demonstrates not only the effect of roentgen irradiation over the vegetative nervous center and ganglia on the blood, but showed that the same result can be obtained with less radiation.

The patient, W. D., aged forty-one, had a blood count before roentgen treatment as follows: red blood cells, 4,140,000; white blood cells, 340,000; Hb, 80 per cent; polymorphonuclears, 37 per cent; small lymphocytes, 4 per cent; large lymphocytes, 1 per cent; eosinophiles, 3 per cent; transitionals, 2 per cent; myelocytes, 53 per cent. The spleen was enlarged and reached two finger breadths below the umbilicus and extended beyond the midline about 1½ inches. The patient received 250 r each side of the neck. The 1st to the 7th dorsal received per cent; transitionals, 1 per cent. The treatment, which consisted of 200 r, was given over each field, as just described for the myeloid leucemia case. The reaction of the white blood cells can be seen in Figure 7. The lymphocytes still showed 60 per cent on the day the patient was last seen which was five days after the last field was exposed. The patient had received roentgen treatment for only four days. He felt well enough, in his opinion, to go about his business. This coincidence proved to be a happy one from the standpoint of our clinical observa-

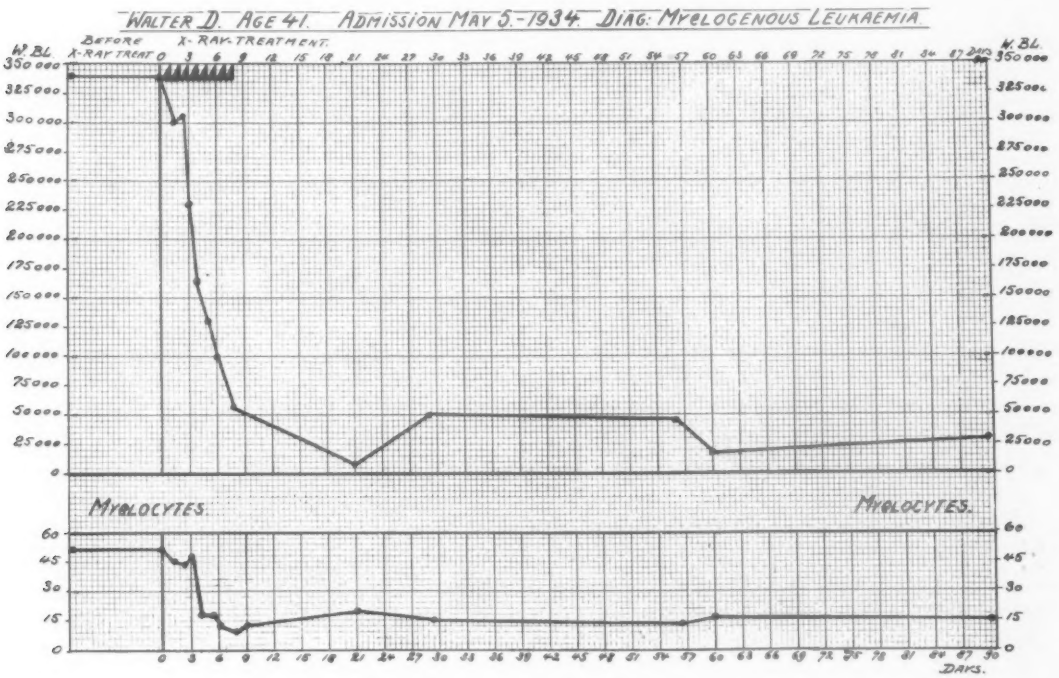

Fig. 6

250 r each over two fields two days later. The 7th dorsal to the 2d lumbar received 250 r each the following day; the 2d lumbosacral region 250 r each field a day later.

Starting with both sides of the head again the whole procedure was repeated. Thus in eight days of treatment each field had received but 500 r. The result of this technique for a ninety day period may be seen in Figure 6.

Lymphatic Leucemia

Mr. I. S., aged forty-eight. First seen June 3, 1931, with the following blood count (Table II): red blood cells, 4,600,000; white blood cells, 29,400; Hb, 90 per cent; polymorphonuclears, 32 per cent; small lymphocytes, 62 per cent; large lymphocytes, 1 per cent; eosinophiles, 4

tion, as I would have continued treatment because of the high lymphocyte count. The patient seemingly remained well and worked every day for two years, at which time he was sent back to us (July 11, 1934) with the blood count shown in Table II. The patient this time received 250 r over each field (both sides of the neck) 1st to 7th dorsal and 7th dorsal to 2d lumbar which amounted to two fields each day for three days. The white blood count was still very high and the pathologic small immature lymphocytes still were 95 per cent of the entire white blood cells.

Instead of repeating the doses as one would be tempted to do, we stopped further treatment and the results can be seen in Figure 8.

TABLE II

I. S. AGE 48. ADMISSION: JUNE 3, 1931. DIAGNOSIS: LYMPHATIC LEUCEMIA

R.B.C.	Hgb.	W.B.C.	Polys.	Sm. L.	L. L.	Eos.	Trans.	
Blood Count Before X-Ray Application over Vegetative Nervous System								
4,600,000	90	29,400	32	62	1	4	1	
Blood Count After Two Days of Paravertebral Treatment								
4,680,000	90	38,600	24	70	5		1	
Blood Count Twelve Days After Beginning of Paravertebral Treatment								
4,500,000	85	10,000	30	60	4	2	4	
Re-Admission July 11, 1934. Diagnosis: Lymphatic Leucemia								
4,690,000	95	45,000	3	97				Immature lymphocytes predominant
One Day After X-Ray Application Left and Right Side of Neck 250 r Each Side								
4,410,000	90	56,000	4	96				Note Stage I reaction expressed in leucemia increase
Blood Count Twelve Days After Beginning of Paravertebral Treatment								
4,370,000	85	9,000	23	76			1	Less immature lymphocytes present
Blood Count One Month After Beginning of Paravertebral Treatment								
4,500,000	90	8,000	38	53	7		2	

A similar observation, but with no recurrence after three years, was made on the following case:

Mrs. C. L., aged thirty. For two years she was under the observation of the referring physician and had complained all this time of pain in the epigastrium, occasionally accompanied by vomiting of bile. The pain extended up towards the scapulae. The last attack was four weeks before admission to the hospital when for three to four days the patient was so weak and complained of such constant pain in the epigastrium that she was unable to leave her bed. Roentgen examination at admission showed a moderately well outlined gallbladder shadow after the use of dye as well as a slight delay in filling. The stomach and duodenum were normal. Considerable enlargement of both liver and spleen was present. Clinical examination also showed considerable enlargement of both the liver and the spleen.

Repeated blood counts revealed a predominance of young pathologic lymph cells which made up to 60 per cent of the total white blood count. The diagnosis of lymphatic leucemia was made. Because the chief complaint was pain it was decided to treat the patient paravertebrally (Fig. 9). The first two fields were from the 1st to the 7th dorsal paravertebral, size of the field 7×18 cm., 200 r each field. The next day two more fields were exposed from 7th dorsal to 2d lumbar, 200 r each field. After the irradiation of the second two fields the pain disappeared. The next day two more fields from 2d lumbar to the sacral region were irradiated, 200 r each field.

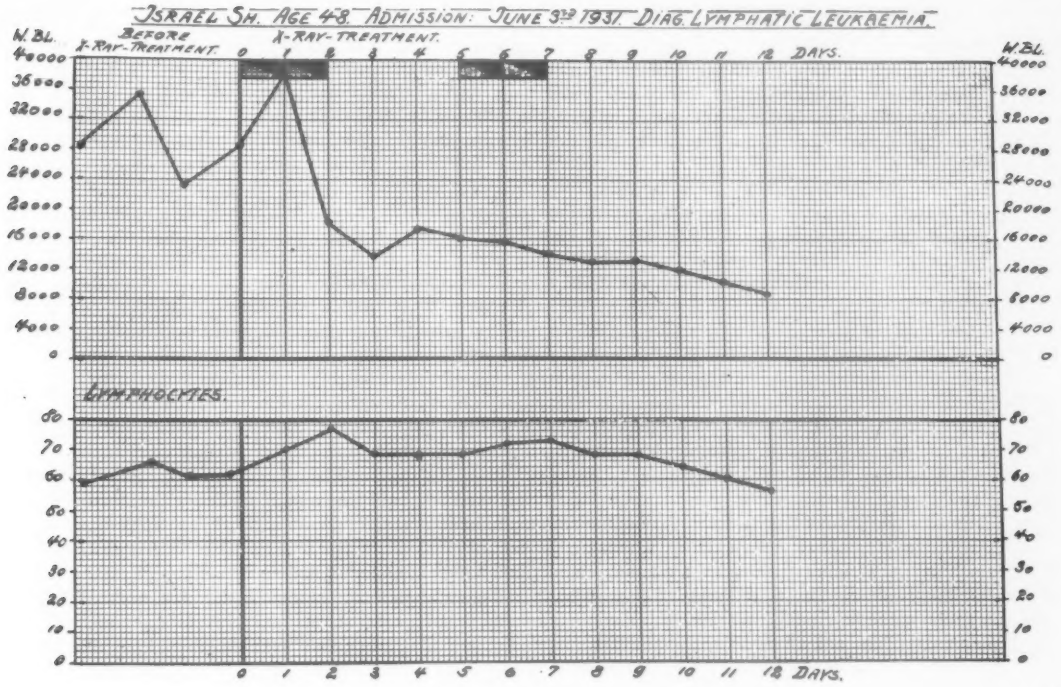

FIG. 7

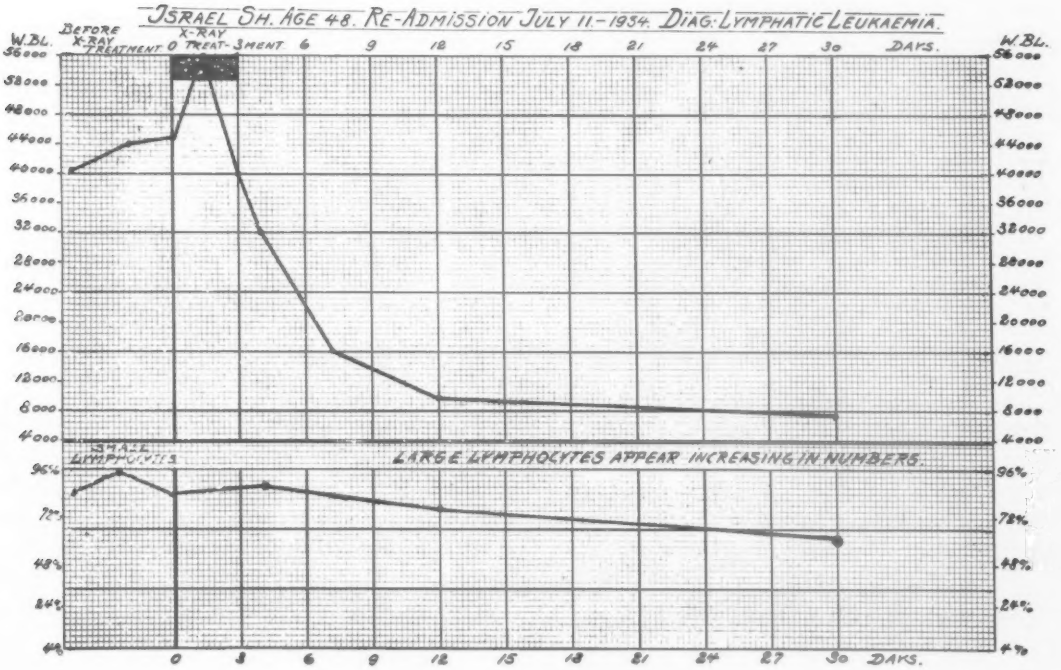

FIG. 8

Each side of the neck, including the diencephalon, was then given 200 r (each field). From the beginning of the treatment the patient experienced a severe roentgen sickness. A blood count disclosed a decided drop in the total white blood cells, a decrease of small lymphocytes,

and an increase of large lymphocytes. The patient refused further treatment, having no more pain and dreading the roentgen sickness.

For another month the referring doctor took blood counts. These did not show any marked change and the patient felt so well that she did not return to the doctor's office. When, three years later she delivered a healthy child in our hospital we had the occasion to have blood counts made from mother and child. Both were entirely normal.

a perfectly normal function of the blood producing organs is observed. When the vegetative nervous system has been in a stage of overirritation for a long time, it is reasonable to suppose that sometimes it may be impossible to establish an equilibrium and then the patient will not respond to treatment.

Providing the patient feels quite well, I have now learned to wait, even if from

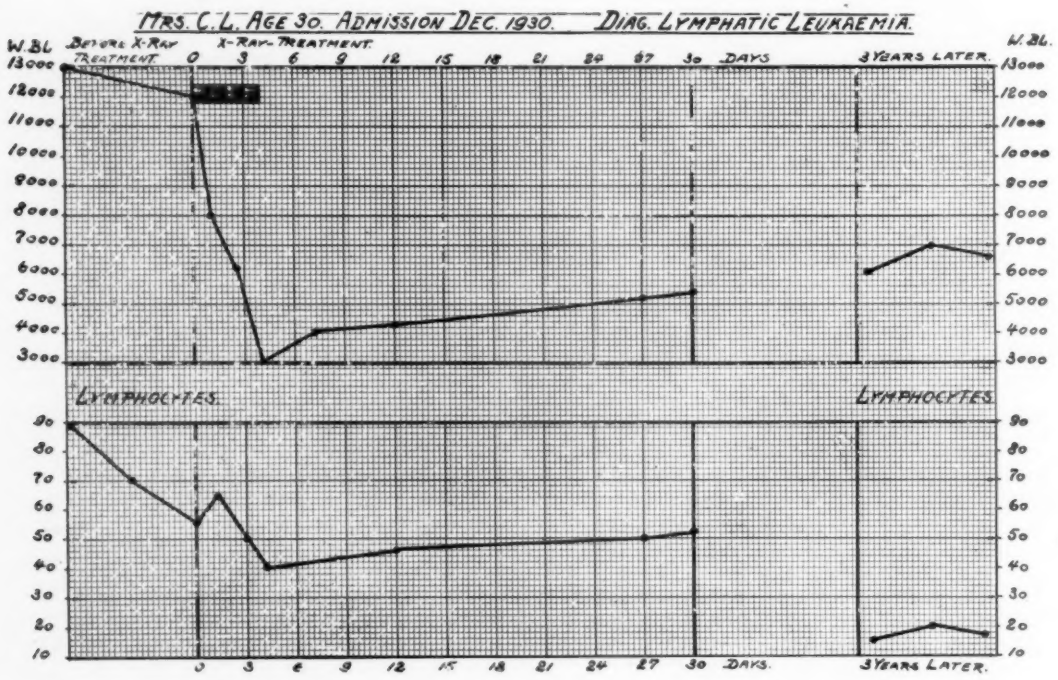

Fig. 9

I believe that this lucky coincidence (the patient refusing further treatment) taught me a lesson which has proved to be extremely valuable. The observation that "the more severe the roentgen sickness, the better will be the result" has been made by me in asthma, thyrotoxicosis, arthritis and other diseases related to an overirritation of the sympathetic nerves and published some time ago. Furthermore it seems that an overirritated nervous system will not immediately start to function normally, but like the arms of a scale, will swing back and forth until an equilibrium is established. It is at this point that time to time the blood count shows a slight pathologic picture. I believe that the basal metabolism and hot flashes are two good measurements by which to be guided. The weight and general appearance of the patient should be considered next in determining the time for further roentgen therapy. "Do not overdose or you will produce irreparable damage" has already been advocated by the older roentgen therapists. So now may I suggest that caution be exercised with regard to the dosage used in leucemia and related diseases. The good results obtained with teleroentgen therapy, where very small

TABLE III

MR. F. M. H. AGE 52. ADMISSION: JANUARY 19, 1934. DIAGNOSIS: POLYCYTHEMIA RUBRA VERA

R.B.C.	Hgb.	W.B.C.	Polys.	Sm. L.	L. L.	Eos.	Trans.	Myelocytes
Blood Count Before X-Ray Appliction Over Vegetative Nervous System								
6,500,000	118	16,000	84	4	1	3	4	4
Blood Count After 1–7 Dorsal Both Sides of Neck 7 Dorsal-1 Lumbar 250 r Each Field Was Given								
6,380,000	117	14,000	74	14	2	2	6	2
Blood Count After 1 Lumbar to Sacrum 250 r Each Field Was Given								
6,330,000	117	16,000	84	5	1	4	4	2
Blood Count After 1–7 Dorsal 250 r Each Field Was Repeated								
6,500,000	118	16,400	88	5	1	1	5	
Blood Count After Both Sides of the Neck 250 r Each Field Was Repeated								
6,500,000	118	14,600	86	10	1		2	1
Blood Count After 7 Dorsal-1 Lumbar and 1 Lumbar to Sacrum 250 r Each Field Was Repeated								
6,430,000	117	16,000	78	8	2	6		
Two Days After X-Ray Treatment Was Finished								
6,200,000	112	10,900	85	6	2		6	
Blood Counts Taken Every Fourteen Days to Three Weeks								
6,290,000	111	8,600	79	16	1	1		
5,650,000	110	11,000	76	12	2	2	8	
5,510,000	107	9,200	76	10	2	2	10	
5,160,000	100	8,400	74	10	6		10	
5,100,000	95–100	9,800	68	22	2		8	
5,020,000	100	9,400	69	18	2	2	8	1
4,910,000	95	10,900	72	16	4		8	
4,980,000	95	8,000	73	14	4	1	8	
4,950,000	95	9,900	70	18	4		8	
4,600,000	95	9,600	75	15	2		8	
4,630,000	90	8,900	70	20	2		8	
4,650,000	90	7,600	70	18	2	2	8	
4,370,000	87	8,200	72	16	4		8	
4,430,000	85–90	7,700	69	20	9		2	
4,430,000	85–90	7,200	69	20	9		2	
4,960,000	95–100	8,400	70	24	4			

doses were used, I believe is an example of how small a dose of roentgen rays is needed to influence an overirritated vegetative nervous system.

The time for another treatment must be judged by clinical observation of the patient. Should the patient's blood count rise slightly, general body sun bath, change of diet, and regulation of body excretion have, without further treatment, often brought about an improvement.

With few exceptions, irradiating the vegetative nervous center and ganglia produced uniform effects on the blood.

Our observations were made on 17 cases of myelogenous leucemia and 13 cases of lymphatic leucemia.

Polycythemia Rubra Vera. As we have had only 3 typical cases of this rare disease, further study on a greater amount of material is desirable. Schulhof and Matthies, experimenting on rabbits, produced polyglobulia by cerebral lesion in order to find the central regulation of the red blood cells. It would appear that the roentgenologist could treat this region of the vegetative center exclusively in polycythemia rubra with beneficial results. I will attempt this on the next case referred to our department. Since Schulhof and Matthies' report came to my attention only recently the 3 cases observed were treated exactly the same as the leucemias. The results of the treatment used were as follows: The first patient, who showed gangrene of the left foot, was operated upon in another hospital, shortly after roentgen irradiation, and his family physician is unable to locate him. The second patient showed typical improvement at first. We gave another series of roentgen applications after which he felt quite well; however, his blood picture has become worse since that time. The third patient has been under observation since January, 1934, and now states that he has never felt better in his life. The blood picture has been normal up to the present time. Table III demonstrates the effect of roentgen irradiation over the vegetative nervous center and ganglia on the blood.

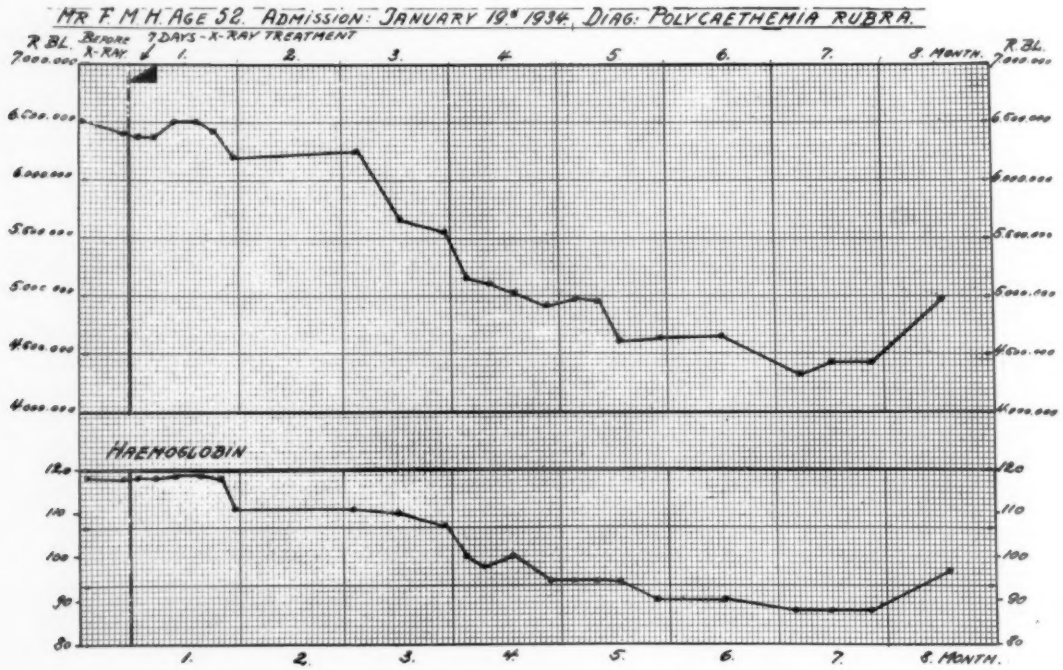

FIG. 10

As can be seen the entire blood picture did not change during the course of treatment, and I am sure one would be tempted to continue treatment. From our past experience, however, we discontinued further irradiation and took blood counts every fourteen days over a period of eight months.

My interpretation of the highly gratifying results observed is that it takes time for such irradiated overirritated vegetative nervous systems to come into balance. The roentgen treatment should not be repeated until there is a steady rise in the blood count.

The graph clearly illustrates the gradual decrease of red blood cells and hemoglobin during the time of observation (Fig. 10).

Lymphogranulomatosis. The relationship between leucemia and lymphogranulomatosis has already been mentioned briefly. As the blood count is not typical in this disease no conclusions can be drawn from it.

A detailed evaluation of the technique used in lymphogranulomatosis maligna (Hodgkin) will be presented at a later time. Anglesio, basing his studies on 49 cases examined histologically, comes to the conclusion that lymphogranulomatosis is essentially a process of productive inflammation, with particular activity shown by the reticulo-endothelial elements (see Piney). If other pathologists can agree with Anglesio's opinion, and if the reticulo-endothelial elements have a central regulation and are under the influence of a vegetative nervous system then the technique as used in the cases reported is justified.

A symmetrical appearance of tumor masses, for instance, in both inguinal, axillary or supraclavicular regions, has often been observed. I connect this symmetrical appearance with an overactivity of the vegetative nervous system.

In order to bring about a depressing effect on the assumed overirritated vegetative nervous centra and ganglia one must first irradiate the centra of this system. The same fields as described in leucemia and Vaquez' disease should be used. We repeat the fields in fourteen days' intervals until 600–800 r each field, has been applied. The dosage used depends again on clinical observation throughout the course of treatment. This treatment alone, we have observed, reduces the size of distant tumor masses in 50 per cent or more of the cases. The direct treatment of the enlarged glands is administered only when the tumor masses appear to enlarge after a certain time, or the patient has distinct complaints—in the region of the tumor masses (pressure pain, for instance) which has not subsided after paravertebral treatment. The direct application, with relatively small doses of roentgen rays, is for the assumed "local productive inflammation," and might be called "anti-inflammatory." Doses of 100–200 r, considering size and depth of tumor, are given, and eventually repeated after an interval of ten days until distinct retrogression of the tumor masses can be observed. It has been our impression that such tumor masses yield more easily to direct roentgen irradiation when paravertebral treatment had been given previously. The remarkable results of Teschendorf and others previously mentioned obtained by teleroentgen therapy may thus find their explanation in the effect of such irradiation on an overirritated vegetative nervous system.

The following table gives a résumé of our results with 12 cases of Hodgkin's disease so diagnosed by competent pathologists on examination of excised glands:

Number of cases observed	Duration of observation	Result
1	5 years	Well
1	3 years	Well
4	2 years	Well
3	1 year	Well
2	8 months	Died
1	2 months	Died

Of the 12 cases, 2 died, one eight months after roentgen treatment and one two months afterwards.

CONCLUSIONS

(1) On the assumption that hyperactivity of the leucopoietic tissues in the blood dyscrasias discussed is related to an overirritation of the vegetative nervous system, a series of cases were treated by roentgen irradiation over the centrum of the vegetative nervous system and its ganglia (paravertebral).

(2) The results strongly support the validity of this assumption.

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DISCUSSION

Dr. G. E. Pfahler, Philadelphia. Dr. Langer has made a most excellent review of the literature and the arguments in favor of the vegetative nervous system being basically related to the blood dyscrasias. Certainly, if irritation or disease of the vegetative nervous system is the cause of these blood dyscrasias, we are justified in treating the ganglia for their relief for there is practically no other way by which one can treat the vegetative nervous system.

I am convinced that roentgenologists in the past have been unmindful or neglectful of the value of irradiation of the vegetative nervous system. This is shown by the results that have been obtained by various authors in the treatment of thrombo-angiitis obliterans. Recently, at the meeting of the International Congress of Radiology held in Switzerland, Nemenow reported on over 300 cases of ulcer of the stomach and duodenum treated with a large percentage of success by a few doses of roentgen rays applied to the sympathetic ganglia. Certainly, since in the treatment of thrombo-angiitis obliterans one does not even bring the rays in the neighborhood of the diseased tissue, and in the treatment of gastric and duodenal ulcer, the amount of dosage is too small to be expected to influence the ulcer directly, and yet good results are produced, one must also consider the possibility of the vegetative nervous system having some influence on the more general diseases, such as the blood dyscrasias. However, when one considers the arguments based upon the technique of the treatment itself, the results obtained are not so easily differentiated from the effect upon the blood directly.

It is probable that one obtains the good results in the treatment of leucemia, for example, by the action of the rays on the blood stream, and therefore, whether we treat the spleen, or the long bones, or the sternum, or the chest, one is really treating over the large mass of blood circulating through these areas. Likewise, when one treats over the sympathetic ganglia along the spinal column, one is treating the carotid arteries in the neck and the entire aorta along the spine. Likewise, when one is treating the entire body by teleroentgen therapy, as I have been doing recently, one is really reaching all of the blood stream at one time, and while the dose is very small, such as 5 or 10 per cent, one is really reaching the entire blood stream during this time.

Therefore, it will be somewhat difficult to prove that even the results that Dr. Langer obtained are not actually due to the treatment of the blood stream. It seems almost impossible to irradiate the vegetative nervous system without also irradiating the large blood streams. However, the final answer to the question will be as to whether we can get more patients permanently well by this technique described by Dr. Langer than we have obtained by the former techniques, and that is the problem that still remains to be solved.

I am sure that we must all feel grateful to Dr. Langer for presenting this new phase of the subject.

Dr. A. H. Pirie, Montreal, Que. I found this a very interesting paper and I want, first of all, to agree and then to disagree with Dr. Langer. I shall first agree with him on one point, his main point that local action can produce distant effect. You know how lichen planus all over the body can be made to disappear by irradiation of the spine. I have seen that and I suppose most of you have. This is a distinct effect from a local action which is very evident because if there is anything on the skin, you can see it at once.

Now to disagree with him, I would like him to consider this case which I did about ten years ago. I had been treating myelogenous leucemias, gradually increasing the dose, until I decided I would try to cure a case by one treatment. I got a very good case with a large spleen, who had never been treated before. I laid him on the roentgen table and with deep therapy gave him such a dose in his spleen that he suffered from roentgen sickness for three weeks afterwards. Before giving him the dose, immediately before giving it, I had his blood counted; it was 650,000 white blood corpuscles. Immediately after he rose from the roentgen table, I had his blood counted again by the same counter, who reported to me 150,000, a sudden drop of nearly 500,000 in one hour.

Will Dr. Langer kindly comment on that case?

Dr. Lester Levyn, Buffalo, N. Y. I was hoping that Dr. Langer would say something about the treatment of polycythemia vera. Just before leaving Buffalo, I left two clinicians in a

conference on the method of choice in the treatment of a case of polycythemia vera. One was insistent on using phenylhydrazine hydrochloride, the other, on bleeding, and so far the patient has had no treatment.

Also, if he has treated cases of this nature, has he ever observed a reduction in the hemoglobin without a corresponding diminution in the number of erythrocytes? I would like very much to know if he has had an opportunity to compare the relative merits of radiation therapy, bleeding and phenylhydrazine hydrochloride in the treatment of this baffling disease.

Dr. R. E. Brenneman, Meadville, Pa. I would like to ask Dr. Langer about herpes zoster, what his results have been by irradiation of the vegetative nervous system. Also, if he has any theory or explanation of the change in blood chemistry after irradiation. For many years, I have noticed after treating malignancies where there was a considerable anemia and a leucocytosis present that I obtained an increase of red cells and of hemoglobin with a decrease in the white cells. Can he explain the biochemistry of this reaction?

Dr. Langer (closing). I am certainly much honored by this very active discussion of my paper. I want to thank Dr. Pfahler for opening the discussion, and also the other discussants for their interest. I am getting a little confused with the number of questions asked but I will try to answer all of them.

The most baffling question, of course, was Dr. Pirie's, and I think I'll answer that first. It is known (I think it was Goldscheider or Jacob) and already reported in 1894, that injection of peptone solution into the circulation was followed immediately by a sharp drop in the number of leucocytes. I also think Peterson and Mueller (Hamburg) came out a couple of years ago with the statement that, by injecting different solutions into the blood stream, the number of leucocytes decreases in the peripheral blood, but an increase of leucocytes in the splanchnic vessels was observed. This shock effect is explained as reaction of the vegetative nervous system. I think this will explain Dr. Pirie's observation that he made immediately after the heavy dosage of roentgen rays over the spleen, namely, the effect of a physiological shock.

Dr. Pfahler mentioned, and I think you all agree with him, that with this technique which I described, the aorta thoracalis, the heart, and the aorta abdominalis are in the path of the roentgen radiation.

Now I cited Lacassagne and Jolly and there are many other investigators who have found that blood is unaffected by direct roentgen irradiation in vitro. I have cited elsewhere that such roentgen sensitive tissues, for instance, as sperm of rabbits, are unaffected by irradiation in vitro, and injected into a female rabbit, a normal litter of healthy animals could be produced. The same roentgen doses applied over the testicle in the male rabbit directly produced sterilization of such male. These experiments speak against the direct effect of roentgen rays on the blood corpuscles.

Now the more important point. If roentgen irradiation is destroying the circulating blood by direct action, how, then, can we explain a temporary increase, as is very often observed, of leucocytes in from a few minutes to twenty-four hours after irradiation? It is a phenomenon which every one of you has observed. I explain this as a Stage I reaction of the treated, overirritated sympathetics going into a temporarily higher stage of irritation and by doing so stimulating a temporarily higher output of the normal or pathological blood tissues before a quiescent Stage II will be observed.

This is always more marked, and I must again come back to Dr. Pendergrass's remark about animal experiments, in case we have to deal with a very highly overirritated sympathetic nervous system. I would practically call it a classical picture of the behavior of an irradiated overirritated sympathetic system expressed in the primary increase and, later on, decreased blood count.

Dr. Levyn wanted to know about the behavior of hemoglobin with a decrease of blood corpuscles, and if the hemoglobin would be lowered before the white blood count comes down. As I told you, I have only 3 cases of polycythemia rubra. I am unable to give a satisfactory answer to that question.

I think it goes too far if we discuss herpes zoster treatment in relation to the sympathetics. There was recently however, an article in *Radiology*, by Keichline (Volume 22, p. 372, 1934) in which was reported x-ray treatment over the spine for 62 cases of herpes zoster, with very excellent results. I think, however, that the author attributed the result to the effect of the irradiation on the dorsal root ganglia of the central nervous system.

THE RÔLE OF ROENTGEN-RAY WAVE LENGTH IN SKIN TOLERANCE*

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FOR something over a decade 200,000 volts has been the conventional maximum voltage used by radiation therapists, and within the last two or three years equipment manufacturers have about solved the problems of roentgen-ray and electrical protection at that voltage. This type of shock-proof equipment had barely been made available, however, when the claim was advanced that for the irradiation of deep-lying structures it was necessary to go to 300, 400, 600, or perhaps 1,000 kilovolts. It is important to note that these claims are based not on actual experience with the newer high voltage machines but on theory developed during work with voltages of 200 kv. and below.

Unlike internists or surgeons who are relatively free to test by experiment innovations in drug or surgical therapy, confident that if these are not successful they can discard them and return to more conservative methods, roentgen therapists must progress slowly in the matter of important voltage changes because these involve radical changes in equipment or even building design and consume large sums of money which will have been wasted if experience shows that the clinical gain of higher voltage is comparatively slight.

Faced with this situation it is obvious that we must scrutinize the logic of the arguments in favor of voltages in excess of 200 kv. and submit to large scale clinical test only those contentions that are found to be logically sound.

These arguments are of three general types:

1. All else being equal, the higher the voltage the better the depth dose.
2. All else being equal, the ability of roentgen rays to destroy neoplastic tissue increases as the wave length decreases.
3. All else being equal, the ability of roentgen rays to injure skin decreases as the wave length decreases.

No one will question the facts involved in contention No. 1 but the magnitude of the improvement in depth dose and the clinical value of such improvement are as yet undetermined. With the development of ionization dosimeters that are accurate at these short wave lengths or even better with the perfection of some of the projected quantitative physiochemical analyses of irradiated tissue, we may be sure that those workers possessing high voltage equipment will attack this clinical problem.

If their experience shows that an improvement in depth dose, however small, is of real clinical advantage, all of us unquestionably must strive for the highest possible voltage. On the other hand, if it shows that there is a critical voltage beyond which increases produce negligible improvement in depth dose and if in the meantime assumptions 2 and 3 are shown to be false, this critical voltage, whatever it may be, will undoubtedly be accepted as standard.

Propositions 2 and 3 conflict with one another, assuming a certain relationship between wave length and one tissue and an opposite relationship in the case of another. Both arguments, of course, are concerned with the involved and controversial problem of the qualitative and quantitative reactions of biological material to irradiation.

Recent papers by Packard[6] and by Exner[3] emphasize that only by painstaking attention to numerous details can one assume the "all else being equal" part of these propositions. Their own experiments

* From the Division of Roentgenology, Department of Medicine, University of Chicago.

Table I

Rabbit No.	Dose			Beginning Reaction	Height of Exfoliation	Definite Healing Begun On	Almost Healed	Remarks
		High Voltage Field	Low Voltage Field					
2 brown	Wulf	3,283 r	3,762 r	8th day	21st day	25th day	40th day	74th day—fully developed indolent ulcer 2×2 cm.
3 white	Wulf	4,924 r	5,643 r	9th day	21st day	34th day	50th day	65th day—telangiectases and several small indolent ulcers.
4 white	Wulf	3,518 r	4,032 r	6th day	19th day	23rd day	40th day	70th day—no ulcers but dry scaling skin.
5 gray	Wulf	3,518 r	4,032 r	7th day	22nd day	25th day	46th day	70th day—large indolent ulcers in both fields.
6 gray	Wulf	6,156 r	7,055 r	3rd day	18th day	26th day	56th day	70th day—dry epilated skin with scales. No ulceration.
7 black and white	Wulf	3,518 r	4,032 r	8th day	26th day	Animal killed on 33rd day for histologic study of skin. Reactions the same in both fields.		
8 gray	Wulf	7,036 r	8,063 r	7th day	24th day	Animal killed on 32nd day for histologic study of skin. Reactions the same in both fields.		
9 gray	Wulf	9,840 r	11,277 r	3rd day	Developed severe diarrhea. Died on 22nd day.			
10 black	Westinghouse	9,381 r	8,897 r	4th day	21st day	34th day	Developed diarrhea and died on 38th day.	
11 gray	Westinghouse	1,599 r	1,516 r	6th day	Shaved hair did not fall out; grew back, obscuring field. Fields appeared identical.			
12 gray	Westinghouse	3,198 r	3,033 r	6th day	When this animal was demonstrated at the Cleveland meeting, the skin was at the height of exfoliation. Reaction was identical in both fields.			

indicate that biological reaction depends solely upon the intensity of the dose absorbed, being independent of wave length over a very wide range, but Packard's survey of the literature shows that while this view is gaining ground, still it is not universally held. Among those who contend that wave length and biological effect are linked, some believe that biological action increases with increasing wave length, others contend that the reverse is true.

Klein and Gaertner,[5] Determann, Jacobi and Holthusen,[2] Chamberlain and Newell,[1] Reisner and Neeff,[7] and many others have investigated the relationship between radiation wave length and the reaction of human skin. Some of these workers used large air-wall chambers on the assumption

that for small skin areas back-scattering could be ignored. Others used thimble type chambers, presumably calibrated for the entire voltage range under examination.

As a result of Holthusen's work, summarized in a recent publication,[4] it is said to be accepted in Europe that erythema bears a quantitative relationship to minute intensity and total intensity but is independent of wave length. However, in this country there is no such agreement and since the matter has become of more importance with the present trend toward increased voltage, it seems desirable to examine the problem again.

The only dosimeter available to us at the beginning was a Wulf instrument, calibrated primarily for work at 200 kv. It is well recognized that in such instruments the string deflection produced by a low voltage beam of given intensity may be less than that produced by a high voltage beam of identical intensity. In this particular case an old calibration chart supplied by the manufacturer stated that at 80 kv. full scale deflection through ten divisions indicated an intensity of 4.4 R while at 200 kv. the same deflection indicated only 4 R. The R refers to Behnken's roentgen unit which was defined at 18° C. so R values must be multiplied by 1.006 if the intensities are to be expressed in the international r which is defined at 0° C.

For a few of the later experiments we used a Westinghouse integrating dosimeter.

We were preparing to construct one of Taylor and Singer's standard air-wall chambers and with the help of members of the University's Department of Physics to re-calibrate these thimble instruments. Pending completion of this work we might have undertaken computations based on the manufacturer's calibration. There was risk, however, that such computations might favor the anticipated result so it seemed better to give to both fields intensities that produced identical *dosimeter readings*. Doing this we assumed that the dose to the low voltage field would be definitely greater than that to the other, the difference being perhaps as great as 10 per cent. Even this much error did not seem important, however, because proponents of argument 3 appear to have in mind differences in skin sensitivity of the order of 100 per cent.

In the months that have elapsed since the reading of our paper* we have completed the standard air-wall chamber and have checked the Wulf and Westinghouse instruments against it. All of the r values in the paper as it now appears are based on calibrations against the Taylor and Singer instrument.

EXPERIMENTS ON 11 RABBITS

The dorsal aspects of both flanks were shaved and fields 2×5 cm. lying on either side of the vertebral column were irradiated, the surrounding tissue being protected by sheet lead. In animals No. 2 to 9 the left field received short wave length radiation produced by a G. E. water-cooled therapy tube (thick-walled type) energized by a double disk mechanical rectifier machine operating at 200 kv. and 25 ma. The beam was filtered through 1 mm. Cu plus 1 mm. Al. Target-skin distance was adjusted (about 36 cm.) until the Wulf dosimeter was discharging at a rate of 14.3 full scale deflections of the string in one minute. We know now that this amounts to 58.6 r per minute. Effective wave length measured by Duane's method, using 0.25 mm. Cu, was approximately 0.146 Å. The right field received long wave length radiation produced by a 10 kw. water-cooled diagnostic tube energized by a double disk mechanical rectifier machine operating at 80 kv. and 8 ma. The beam was filtered through 6 mm. Al. Target-skin distance was adjusted (about 30 cm.) until the Wulf dosimeter with its thimble at the skin showed the same deflection as in the case of the high voltage field. The dose, therefore, was 67.2 r per minute. (Effective wave length approximately 0.41 Å.)

In animals No. 10 to 12 irradiation for both fields was supplied by an oil-immersed shockproof tube operating on a two-valve rectified transformer. The operating conditions for the high voltage field were: 200 kv., 25 ma., target-skin distance 41 cm. The beam was filtered through 1.2 mm. Cu plus 1 mm. Al. (The 0.2

* Section on Radiology, American Medical Association, Cleveland, Ohio, June, 1934.

mm. Cu is the manufacturer's estimate of the filtering effect of tube wall, oil and bakelite-window. Effective wave length was approximately 0.142 Å.) The factors for the low voltage field were: 80 kv., 25 ma., target-skin distance 41 cm. The beam was filtered through 0.2 mm. Cu. (The 0.2 mm. Cu is the manufacturer's estimate of the filtering effect of tube wall, oil and bakelite window. Effective wave length approximately 0.34 Å.) For these 3 animals target-skin distance was constant for both fields, exposure times differed but both fields received the same dose in roentgens as indicated by a Westinghouse integrating dosimeter. We know now that in these 3 cases the total dose to the low voltage fields was approximately 5 per cent less than that to the high voltage fields.

Criteria Employed. Date of epilation; intensity, time of onset and duration of erythema and ulceration; date of healing and date and degree of late ulceration when it occurred were the criteria employed to judge the "reactions" in these rabbit experiments.

In all of the animals except No. 9 the reaction in both fields was the same. It consisted of fine and later coarse exfoliation over a moist surface, followed by subsidence of the reaction and more or less complete healing. In some of the animals healing was not permanent but was followed by the development of indolent ulcers.

Microscopic section of the skins of rabbits No. 7 and 8 showed the type of skin atrophy commonly found following heavy irradiation. The epithelial layer was markedly thinned but covered with keratohyaline crust. The basal layer instead of being undulant as it is in normal skin was smooth and there was atrophy of almost all of the hair follicles and sebaceous glands. No difference could be made out between sections from the high voltage areas and those from the low voltage areas.

Rabbit No. 9. This animal developed an intense diarrhea and died twenty-two days after receiving 9,840 r to the high voltage field and 11,277 r to the low voltage side. Erythema was first noted on the third day at which time it was more pronounced in the right field—that is, the side receiving the low voltage radiation. The difference became more noticeable as time progressed and on the fifth day after irradiation, whereas the left or high voltage field looked about the same as in the other animals, the right or low voltage field was swollen and blue. The difference in reaction continued to become more pronounced throughout the life of the animal up to the eleventh day. We are convinced that experimental error explains the findings in this case. In the first place, the extremely long exposure time overtaxed the diagnostic machine used for the low voltage field, necessitating frequent shut-downs which probably added to the errors of measuring the dose. Secondly, lead protective material which had been used to shield one area while the other was being irradiated was found to be inadequate protection when the high voltage exposures were as long as in this case. In a subsequent animal, rabbit No. 10, where particular care was taken to avoid these two errors the reaction of the two areas was identical.

Discarded Experiment on One Other Rabbit. Rabbit No. 1 died of intercurrent infection shortly after receiving 3,693 r to the high voltage field and 4,232 r to the low voltage field.

EXPERIMENTS ON 7 HUMAN SUBJECTS

The flexor surface of the forearm was used, two fields being mapped out close to each other so that conditions for comparison were optimum. The upper field received short wave length radiation produced by a G. E. oil-cooled, oil-immersed, shock-proof tube energized by a double-valve tube rectified transformer operating at 200 kv., 25 ma. The beam was filtered through 1.2 mm. Cu plus 1 mm. Al. (The 0.2 mm. Cu is the manufacturer's estimate of the filtering effect of tube wall, oil and bakelite window. Effective wave length was approximately 0.142 Å.) Target-skin distance was 40.5 cm. The Wulf dosimeter with its thimble chamber resting on the skin discharged at a rate of 13 full scale deflections per minute. The dose, therefore, was 53.3 r per minute. The lower field received long wave length radiation produced by a medium focus Coolidge tube energized by a double disk mechanical rectifier machine operating at 80 kv. and 6 ma. The beam was filtered through 1 mm. Al and the effective wave length was approximately 0.365 Å. The target-skin distance was 27.5 cm. The intensity was such that a Wulf dosimeter with its thimble chamber on the

TABLE II

Patient and Age	Dose	Fields	12 Hours	24 Hours	5 Days	10 Days	20 Days	30 Days	40 Days
I W. M. 31	800 r	kv. 200	Slight erythema	Slight erythema	Erythema fading	Very faint erythema	Very faint brown pigmentation	Moderate ++ erythema	Brown pigmentation
Brunet	717 r	80	Slight erythema	Slight erythema	Erythema fading	Very faint erythema	Very faint brown pigmentation	Marked ++++ erythema	Same degree as above
II P. H. 30	640 r	200	No reaction	No reaction	Slight brown pigmentation	Increased pigmentation	Pigmentation fading	Pigmentation fading	Pigmentation almost faded
Dark brunet	733 r	80	No reaction	No reaction	Slight brown pigmentation	Increased pigmentation	Pigmentation fading	Pigmentation fading	Pigmentation almost faded
III A. M. 62	853 r	200	Slight erythema	Slight erythema	Slight brown pigmentation	(Not seen)	Almost invisible	Moderate ++ erythema	Reactions equalizing; pigmentation still more marked in low voltage field
Light brunet	977 r	80	Slight erythema	Slight erythema	Slight brown pigmentation			Marked++++ erythema	
IV C. O. 25	746 r	200	No reaction	No reaction	Slight erythema	Slight erythema	Slight erythema and pigmentation	Faint brown pigmentation	Reaction almost faded
Light brunet	855 r	80	No reaction	No reaction	Slight erythema	Slight erythema	Slight erythema and pigmentation	Faint brown pigmentation	Reaction almost faded
V H. H. 29	640 r	200	Slight erythema	Slight erythema	Erythema fading	Fading	Slight erythema and pigmentation	Faint brown pigmentation	Reaction almost faded
Blond	733 r	80	Slight erythema	Slight erythema	Erythema fading	Fading	Slight erythema and pigmentation	Faint brown pigmentation	Reaction almost faded
VI J. C. 62	800 r	200	No reaction	No reaction	Erythema fading	Faint erythema	As before	Faint brown pigmentation	Reaction almost faded
Gray	917 r	80	No reaction	No reaction	Erythema fading	Faint erythema	As before	Faint brown pigmentation	Reaction almost faded
VII H. R. 32	853 r	200	Slight erythema	Slight erythema	Erythema fading	Slight erythema	As before	Moderate ++ erythema	Slight erythema
Red hair, ruddy skin	977 r	80	Slight erythema	Slight erythema	Erythema fading	Slight erythema	As before	Marked ++++ erythema	Slight erythema

skin gave the same reading as in the case of the high voltage field. The dose, therefore, was 61.1 r per minute.

Epilation was not studied because the subjects differed so greatly as to the amount of hair and some of the arms were shaved. The time of appearance and degree of erythema and pigmentation were the criteria used. The results are expressed in Table II. In 4 of the 7 cases the reaction in the two fields was identical but in 3 the reaction was definitely greater in the low voltage field.

Three Human Cases in Which There Where Differences Between High Voltage and Low Voltage Areas

Case I. W. M., male, brunet, aged thirty-one, dose 800 r high voltage field, 917 r low voltage field. Until the twentieth day reactions identical. Erythema developed at twelve hours; reached its height in twenty-four hours; faded by the fifth day, and had almost disappeared by the tenth. On the twentieth day very faint brown pigmentation. At the thirtieth day high voltage field showed moderate erythema; low voltage field, marked erythema; but by the fortieth day pigmentation in the two areas was identical.

Case III. A. M., male, light brunet, aged sixty-two, dose 640 r high voltage field, 733 r low voltage field. About the same as Case I—that is, identical reaction up to the twentieth day. On the thirtieth day erythema more marked in low voltage field. By the fortieth day there was still more pigmentation in the low voltage field.

Case VII. H. R., male, red hair, ruddy skin, aged thirty-two, dose 853 r high voltage field, 977 r low voltage field. Reaction in two fields identical until the twentieth day. On the thirtieth day erythema more marked in low voltage field. By the fortieth day reaction about the same.

We cannot believe that a trivial difference of this sort apparent only in the third erythema wave in 3 of the 7 human cases indicates a genuine susceptibility of skin to long wave length radiation. In all of the human experiments and all but the last three of the rabbit experiments, the low voltage fields received about 15 per cent more radiation than the high voltage fields. Presumably all of the rabbits and four-sevenths of the human subjects had skin too insensitive to show this degree of difference in dose.

CONCLUSIONS

1. Eight rabbits and four out of seven human subjects showed identical skin reactions in areas irradiated with (*a*) 200 kv. heavily filtered roentgen rays; (*b*) 80 kv. slightly filtered roentgen rays, Wulf dosimeter readings being identical for both areas.

2. Over the voltage range employed and with this particular dosimeter, the intensity to the 80 kv. field was greater than that to the 200 kv. field by approximately 15 per cent.

3. In three of the human cases the reaction in the two areas was the same during the early stages and at the end, but there was a brief period about one month after irradiation when erythema was distinctly greater in the low voltage field. This is interpreted as showing that only at certain stages of the reaction and only in particularly sensitive subjects will slight differences in intensity produce recognizable differences in the degree of erythema.

4. In three additional rabbit experiments where the Westinghouse dosimeter was used the low voltage fields received about 5 per cent less radiation than the high voltage fields. Here, too, the reactions seemed identical.

5. Over the voltage range from 80 kv. to 200 kv. the degree of reaction of skin to irradiation is independent of wave length.

6. There is no reason to suppose that the situation will be different for voltages in excess of 200 kv.

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Vol. 34, No. 2

THE DANGERS OF ROENTGENOSCOPY AND METHODS OF PROTECTION AGAINST THEM

VI. SOME STUDIES OF THE "DOSES" RECEIVED BY THE BODY OF THE EXAMINER*

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WE NEXT proceeded to measure, by means of the large (500 c.c.) chamber, the "dosage" received by the operator's body in "scattered" and "secondary" radiation. For this purpose the wax phantom was suspended by means of strong cord, to avoid the effect of any supporting structure, in front of the vertical roentgenoscope. A 20 cm. beam was used to facilitate reading the ionization chamber and the screen was placed in front of the phantom in its usual position during actual examination. The ionization chamber was then placed at varying heights, from the floor up to 5 feet (1.5 meters), and at varying positions in regard to the phantom, and its discharge time was noted. The following positions were used: 18 and 36 inches (45 and 90 cm.) from the back board of the roentgenoscope, directly in front of the phantom (positions *a* and *b*), 24 inches (60 cm.) from the back board at an angle of 45° to the plane of the back board (position *c*), and finally directly to the side of the phantom at a distance of 24 inches (position *d*) 3 inches (7.5 cm.) in front of the plane of the back board (Fig. 1).

The following readings were obtained in position *a*: at a height of 5 feet, 0.027 r in 1 minute and 25 seconds; at a height of 4 feet, 0.0054 r in 6+ minutes; at a height of 3 feet, 0.0054 r in 6+ minutes; at a height of 2 feet, 0.027 r in 55 seconds; and on the floor, 0.027 r in 2 and 1/12 minutes. In position *b*: at a height of 5 feet, 0.027 r was measured in 3 and 1/16 minutes; at heights of 4, 3, and 2 feet the discharge time was 4 minutes and 30 seconds, 4 minutes and 30 seconds, and 2 minutes and 35 seconds, respectively, probably due to scattering around the screen, and at the height of 1 foot, 0.0054 r was discharged in 4 minutes. In position *c* we noted that at the height of 5 feet, 0.027 r was delivered in 1 minute and 42 seconds, at the height of 4 feet, 0.027 r was delivered in 1 minute and 1 second, at the height of 3 feet, 0.027 r was delivered in 1 minute and 40 seconds, and at the height of 2 feet, 0.027 r was delivered in 1 minute and 17 seconds. Finally, in position *d*, at a height of 5 feet, 0.027 r was delivered in 1 minute and 26 seconds, at 4 feet, 0.027 r was delivered in 48 seconds, at 3 feet, 0.027 r was delivered in 55 seconds, at 2 feet, 0.027 r was delivered in 1 minute and 38 seconds, and at the floor, 0.027 r was delivered in 3 minutes and 17 seconds.

For greater convenience, these measurements are arranged in tables; first the actual measurements are tabulated in Table I, then the results in terms of 10 mu r a second are determined and listed in Table II. Ten mu r a second is considered the "tolerance dose" by Behnken, since this dose, if received over a seven hour day, corresponds to the accepted "tolerance dose" of Glocker and others. Finally, in Table III the scattering is determined in mu r per second, correction being made for the decrease due to a 10 cm. square beam.

* Abstract of thesis submitted by Dr. Cilley to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirement for the degree of Master of Science in Radiology.

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TABLE I

INTENSITIES OF RADIATION ABOUT THE VERTICAL ROENTGENOSCOPE. CALCULATION IN S.E.D. PER MINUTE BASED ON 400 r AS AN S.E.D.

Height from floor, feet	Position *a*		Position *b*		Position *c*		Position *d*	
	18 inches		36 inches		24 inches, 45° ı		24 inches to side	
	Time, seconds	Roentgens	Time, seconds	Roentgens	Time, seconds	Roentgens	Time, seconds	Roentgens
5	85	0.027	190	0.027	102	0.027	86	0.027
4	*		270	0.0054	61	0.027	48	0.027
3	*		270	0.0054	100	0.027	55	0.027
2	55	0.027	155	0.0054	77	0.027	98	0.027
ı Floor	125	0.027	332	0.027			197	0.027
+	Average S.E.D. per minute = 0.0000143		Average S.E.D. per minute = 0.00000958		Average S.E.D. per minute = 0.000047		Average S.E.D. per minute = 0.000056	
	Highest S.E.D. per minute = 0.000073				Highest S.E.D. per minute = 0.0000675		Highest S.E.D. per minute = 0.000084	

* In position *a*, the chamber was not sufficiently sensitive to record the intensities behind the screen with any degree of accuracy.

\+ The average S.E.D. per minute is based on the average of the 2, 3, 4, and 5 foot measurements for each position.

TABLE II

SCATTERING ABOUT VERTICAL ROENTGENOSCOPE USING 20 CM. SQUARE BEAM

Height from floor, feet	Results in terms of 10 mu r per second = unity			
	Position *a*	Position *b*	Position *c*	Position *d*
5	31.7	14.2	25.4	31.3
4		2.0	44.2	46.2
3		2.0	27.0	49.0
2	49.0	3.4	35.0	27.5
Floor	21.5	8.1		13.1

TABLE III

SCATTERING ABOUT VERTICAL ROENTGENOSCOPE CORRECTING FOR 10 CM. SQUARE BEAM

Height from floor, feet	Results in terms of 10 mu r per second = unity			
	Position *a*	Position *b*	Position *c*	Position *d*
5	9.6	4.3	7.9	9.4
4		0.6	13.3	13.9
3		0.6	8.1	14.8
2	14.8	1.0	10.6	8.3
Floor	6.5	2.4		3.9

These tables may be compared to the findings of Behnken, Glocker and Reuss, and Schlechter. Behnken irradiated a water phantom with a metalix roentgen tube. The phantom was 45 cm. long, 18 cm. deep, and 25 cm. broad. The tube, activated by 75 kv. p., 4 ma. and 0.5 mm. Al filter, was placed 15 cm. from one small face of the phantom with no intervening shutters. The scattering was carefully charted in isodose curves out to a distance of 140 cm. from the phantom. The isodose lines are very irregular, indicating concentrations of rays at angles of about 45° and 70° to the plane of the long axis of the phantom traversed by the central ray.

Compared at like points with our measurements, we find that, with the 20 cm. beam at 45 cm. (position *d*) to the side of the phantom, the intensity is 462.10^{-5} r per second, whereas Behnken found 60.10^{-5} r per second. Comparing our position *c* (at 24 inches and a 45° angle) at a height of 3 feet with Behnken's corresponding curve,

we measured 49.10^{-5} r per minute and Behnken 100.10^{-5} r per minute. These differences may be explained on the basis of a difference in sensitivity of the measuring devices, tube-phantom distance, machines used, and filters. Our measurements are comparatively conservative, but they agree rather well with his. It is interesting to note that Behnken found scattering from the same phantom, when irradiated at a potential of 200 kv. p. with 0.8 Cu filtration, to be of the same general order of intensity. In the line of the central ray, Behnken found, at a distance of 1.5 meters, fifteen to twenty times the tolerance dose. Of course this was measured without the screen in place.

Glocker and Reuss stressed the superimposition of scattered rays, which makes it impossible to postulate accurately the intensity at any given point from measurements at equal distances from the phantom at other points. They irradiated a water phantom which measured 20 by 20 by 20 cm. To check the work of Schlechter, they set their phantom up 70 cm. from the tube and measured the scattered radiation at a distance of 50 cm. from the center of the phantom in a plane perpendicular to the central ray. Schlechter, using 70 kv. p., 5 ma., and 1.5 mm. Al filter, found the intensity to be 8.10^{-5} r per second. Glocker and Reuss, using 110 kv. p., 5 ma., 0.5 mm. Al filter, found the intensity at a point about 5 cm. posterior to Schlechter's point to be 19.10^{-5} r per second, and they concluded the agreement to be very good considering the different factors used. Continuing these experiments and using a 30 cm. tube-phantom distance with the same factors, they found the intensity of scattering to be 12.10^{-4} r per second. Our measurements on the same general line 5 cm. closer to the phantom are 49.10^{-5} r per second. Again, we feel, they are conservative, considering all the factors involved. Lastly, Chantraine and Profitlich, screening the stomach of a thick patient with a 30 by 40 cm. field size, and using 90 kv. p. and 5 ma. current, found the scattering at 1.5 meters to be 11.10^{-5} r per second; this agrees well with our findings.

Next, in order to determine the scattered ray "dosage" received during the screening of colons, the phantom was placed on one of the colon tables, a 20 cm. square beam was used, and measurements were made with the 500 c.c. chamber on lines perpendicular to the floor. Three positions were chosen for these measurements:

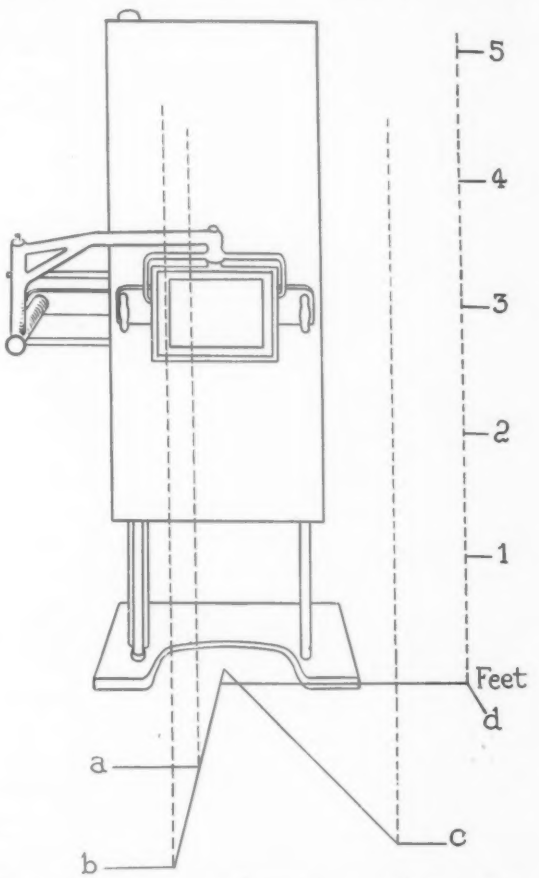

Fig. 1. Measurement of secondary radiation about the vertical roentgenoscopic unit with the 21 cm. phantom in the position of the patient; *a* and *b* are points on the floor 18 and 36 inches from, and on a line perpendicular to, the back board opposite the center of the phantom; *c* is a point on the floor 24 inches from the back board on a line drawn at a 45° angle to the back board from a point opposite the center of the phantom; *d* is a point on the floor 4 inches anterior to the plane of the back board and 24 inches from the center of the phantom. Measurements were made at various heights on lines perpendicular to the floor from these points.

opposite the center of the phantom and 6 inches (15 cm.) from the side of the table (position *e*), and 24 inches to the foot end of the phantom and 6 inches from the side of the table (position *g*) (Fig. 2).

The intensity of radiation measured in these three positions at various heights from the floor was as follows: in position

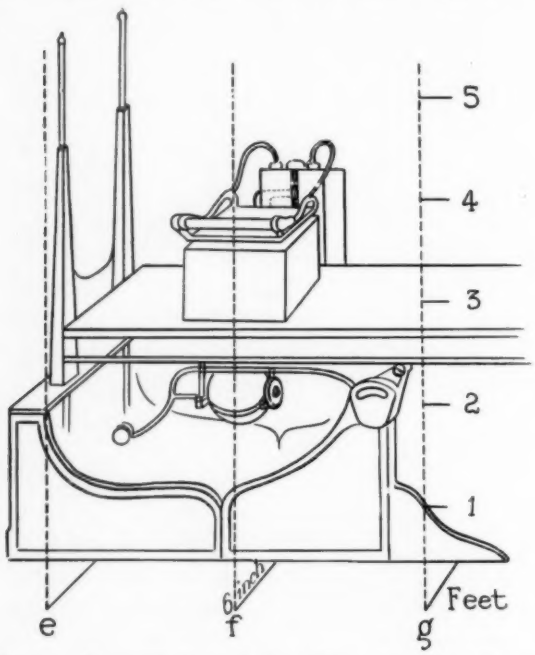

Fig. 2. Measurement of secondary radiation about the horizontal roentgenoscopic unit; *f* is a point on the floor opposite the center of the phantom 6 inches from the side of the table; *e* and *g* are points on the floor each 24 inches from point *f* and 6 inches from the side of the table. Measurements were made at various heights on lines perpendicular to the floor from these points.

f the 500 c.c. chamber discharged 0.0054 r in 86 seconds at a height of 5 feet, 0.027 r in 47 seconds at a height of 4 feet, 0.027 r in 26 seconds at a height of 3 feet, 0.0054 r in 126 seconds at a height of 2 feet, and 0.0054 r in 126 seconds at the floor. In position *e* the 500 c.c. chamber discharged 0.027 r in 3 minutes and 15 seconds at a height of 5 feet, 0.027 r in 127 seconds at 4 feet, 0.027 r in 115 seconds at 3 feet, 0.0054 r in 110 seconds at 2 feet, and 0.0054 r in 130 seconds at the floor. In position *g* the same chamber discharged 0.027 r in 210 seconds at 5 feet, 0.027 r in 130 seconds at 4 feet, 0.027 r in 114 seconds at 3 feet, 0.0054 r in 200 seconds at 2 feet, and 0.0054 r in 4 minutes at the floor. The readings with the ionization chamber are listed in Table IV. In Table V the measurements are tabulated in terms of average S.E.D. per minute and highest S.E.D. per minute. In Table VI the measure-

Table IV

DISCHARGE TIME ABOUT TABLE

Height from floor, feet	Position *f*		Position *e*		Position *g*	
	Opposite center of beam		24 inches to head of beam		24 inches to foot of beam	
	Time, seconds	Roentgens	Time, seconds	Roentgens	Time, seconds	Roentgens
5	86	0.0054	195	0.027	210	0.027
4	47	0.027	127	0.027	130	0.027
3	26	0.027	115	0.027	114	0.027
2	126	0.0054	110	0.0054	200	0.0054
1						
Floor	126	0.0054	130	0.0054	240	0.0054

Table V

SHOWING AVERAGE AND HIGHEST S.E.D. PER MINUTE

Position	Position *f*	Position *e*	Position *g*
	Opposite center of phantom	24 inches to head of table	24 inches to foot of table
Average S.E.D. per minute	0.0000341	0.0000237	0.0000198
Highest S.E.D. per minute	0.00015	0.0000352	0.0000355

Table VI

MEASUREMENTS ABOUT THE HORIZONTAL ROENTGENOSCOPIC UNIT

Height from floor, feet	Values in terms of 10 mu r second		
	Position *e*	Position *f*	Position *g*
5	6.2	13.8	12.9
4	57.4	21.2	20.5
3	103.8	23.4	23.6
2	4.2	4.9	2.7
Floor	4.2	4.1	2.2

ments are tabulated in terms of 10 mu r a second equals unity; in other words, in terms of the r per second "tolerance dose."

The measurements correspond well with the measurements made around the vertical roentgenoscope.

A number of interesting observations were made during these measurements. In considering the vertical roentgenoscope measurements, the intensity at a distance of 36 inches (position *b*) outside the shadow of the screen was always approximately four-ninths that at the 18 inch distance. This apparent departure from the law of inverse squares is probably due to the fact that the radiation from the roentgen tube comes from a surface and not from a point. In the shadow of the screen, at a distance of 36 inches, the chamber records approximately twice the radiation measured at the distance of 18 inches, due probably to increased scattering around the screen at this distance. At a height of 3 feet, on the vertical line 24 inches from the center of the back board and at a 45° angle to the plane of the back board (position *c*) 100 seconds is required to discharge 0.027 r as opposed to 61 seconds at a height of 4 feet and 77 seconds at a height of 2 feet. This is undoubtedly due to the shadow of the screen falling partially across this line at the height of 3 feet. For the rest of the vertical measurements, the results seem fairly close to what might be expected, considering the differences in distance and relative position involved.

The measurements about the horizontal (colon) tables indicate some marked decreases in intensity about the 1 foot and floor lines, due to the interference of the table supports and tube holder with the spread of the "scattered" and "secondary" rays. This decrease below the level of the roentgen tube indicates that the direct radiation escaping from the tube is negligible in comparison with that scattered from the patient and fixtures. This bears out the consensus of opinion.

We next turned to the photographic determination of the "dosage" received by the bodies of the examiners through the medium of rays emanating from the bodies of the patients examined, the equipment, and so forth. In these determinations the examiners wore a series of films, for the most part arranged at intervals of 6 to 8 inches and extending from about the level of the second rib to the knee. The films were fastened firmly by clips to the laboratory coat or clothing of the examiner. In Table VII the individual series of films are listed in order from above downward.

The ionization chamber and photographic methods of measurement check as closely as can be expected, considering the type measurements for which they were used; the one being arbitrary and the other subject to considerable error, aiming at measuring the dosage received during so complicated and variable a procedure as an examination. In Table VIII the measurements in terms of erythema dosage per minute of examination are compared.

The greatest discrepancy, that observed between the film and ionization chamber measurements for the position in front of the vertical roentgenoscope, is most readily explainable. The trunk and lower extremities of the patient offer a tremendous filtering effect on the scattering about the beam, as we showed by the experiments on the effect of beam size on scattering. The beam used in measuring colons is frequently smaller than the 20 cm. beam on which our entire calculation for colon examination is based; moreover, for an appreciable part of the examination the left colon is being investigated, bringing a great deal of the patient's body, with its equivalent filtering effect, between the edge of the beam and the operator. Assuming the error of the photographic method as used by us to be not greater than 40 per cent, and our ionization chamber measurements to be accurate within 20 per cent, there is still a tremendous difference in the results of the measurements. This difference is most readily explained by our inability to duplicate the roentgenoscopic procedures of examination.

TABLE VII

PHOTOGRAPHIC MEASUREMENT OF SACTTERED RAY DOSAGE

Number of days worn	Number of films worn	Operator or observer	Minutes of exposure during examination		Film dosage in order from second rib to knee in S.E.D	Average exposure in S.E.D.	Average exposure per minute in S.E.D.	Greatest exposure per minute in S.E.D.
			Stomachs	Colons				
2	1	C	42	24	0.00003	0.00003	45.10^{-8}	
6	1	J	51	63	0.00053			
6	2	J	51	63	0.00038			
6	3	J	51	63	0.00018			
6	4	J	51	63	0.0001	0.00029	26.10^{-7}	42.10^{-7}
4	1	W		105	0.0007			
4	2	W		105	0.0005			
4	3	W		105	0.0005	0.00056	53.10^{-7}	66.10^{-7}
6	1	K						
6	2	K	193		0.00007			
6	3	K	193		0.00007			
6	4	K	193		0.00002			
6	5	K	193		0.00005	0.000042	21.10^{-8}	36.10^{-8}
6	1	C	70	51	0.00026			
6	2	C	70	51	0.00024			
6	3	C	70	51	0.00021	0.00023	19.10^{-8}	21.10^{-7}
6	1	H	30	152	0.00076			
6	2	H	30	152	0.00092			
6	3	H	30	152	0.0006	0.00076	41.10^{-7}	50.10^{-7}

TABLE VIII

COMPARISON OF PHOTOGRAPHIC MEASUREMENTS AND IONIZATION CHAMBER MEASUREMENTS BASED ON ACTUAL TUBE CURRENT USED DURING EXAMINATION

Part	Average S.E.D. per minute. Photographic	Average S.E.D. per minute. Ionization chamber	High S.E.D. per minute. Photographic	High S.E.D. per minute. Ionization chamber	Approximate discrepancy ratio
Stomach examination. Proximal three-fourths of fingers	0.00001	0.000115			11.5:1
Stomach examination. Palm of hand	0.00002	0.00010			5:1
Colon examination. Hand	0.00004	0.000078			1.9:1
Scattered rays. Stomach	0.00000021	0.0000095	0.00000036	0.000021	45:1
Scattered rays. Colon	0.0000053	0.0000341	0.000066	0.000155	6+:1

SUMMARY

In the routine examination of both the stomach and the colon the examiners wear no protective devices whatever. We have presented in this paper some studies of the intensity of radiation the bodies of these men have tolerated without apparent injury. The discrepancies between the results of a photographic and an ionization system of measurement are pointed out and some reasons for them are given. In spite of the fact that these examiners have sustained multiples of the "tolerance dose" with impunity, we nevertheless advocate

no change whatever in the accepted methods of protection. The results of this study emphasize the necessity for the use of speed, for the protective effect of the barium-filled viscus, and for the smallest possible beam during roentgenoscopy, if injuries are to be minimized.

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Publisher: Charles C Thomas, 220 East Monroe St., Springfield, Illinois.

Issued Monthly. Subscription $10.00 per year, $11.00 in Canada and $12.00 in foreign countries. Advertising rates submitted on application: Editorial office, 110 Professional Building, Detroit, Mich. Office of publication 220 E. Monroe St., Springfield, Ill. Information of interest to all readers will be found on page iv.

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Twenty-first Annual Meeting: Kansas City, Mo., May 11–12, 1936.

EDITORIAL

THE ANNUAL MEETING

THE Annual Meeting of the American Roentgen Ray Society, the Thirty-sixth regular meeting since the organization of the Society, will be held in Atlantic City, New Jersey, September 24 to 27, 1935, at Haddon Hall. Dr. Fred M. Hodges, the President-elect of the Society, has arranged a very comprehensive and instructive program. This is published elsewhere in this issue of the Journal. One needs only to make a careful survey of the program to appreciate the importance and influence of the roentgen ray as an aid in both experimental and clinical investigations. The program is fairly evenly balanced between papers of diagnostic and therapeutic interest and research.

The Society is fortunate in having among its guests Dr. Henri Coutard of Paris, France, who will discuss the "Present Additional Treatment with Roentgen Rays in Carcinoma of the Cervix and Protracted Roentgen Therapy of the Pelvis," and Dr. J. Shelton Horsley of Richmond, Virginia, who will give the Caldwell Lecture.

An interesting feature of this year's arrangement of the program is that time is allotted to permit of a special study of the scientific exhibits, with personal demonstration by the exhibitors. Heretofore the scientific program has been so lengthy that sufficient opportunity has not been available to study the scientific exhibits but fortunately this fault has now been corrected.

The commercial exhibits promise this year to be up to the standard of former meetings. Fortunately the commercial exhibits will be placed in easy access to the meeting room so that there will be an opportunity to see the newer designs and features of roentgen-ray apparatus which have been developed during the past year. The rapidity of development and incorporation of new ideas in roentgen machines make it important that no member should fail to visit the commercial exhibits. A list of the exhibitors is published elsewhere in the Journal.

Atlantic City offers an ideal meeting place not only on account of its easy accessibility and the hotel accommodations at Haddon Hall, but also on account of the climatic conditions.

The meeting place, the scientific program, the exhibits and the improved economic conditions justify the hope that this will be one of the best attended meetings that the Society has had in a number of years.

Those who plan to attend should make hotel reservations at the earliest possible moment because not infrequently during the month of September the hotels at Atlantic City are crowded.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. E. P. Pendergrass, University Hospital, Philadelphia, Pa. Annual Meeting: Atlantic City, N. J., Sept. 24–27, 1935.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. B. H. Orndoff, 2561 N. Clark Street, Chicago, Ill. Annual meeting: Kansas City, Mo., 1936.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. J. T. Murphy, 421 Michigan St., Toledo, Ohio. Annual meeting: Kansas City, Mo., 1936.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N.Y. Annual meeting: Detroit, Mich., Dec. 2–6, 1935.

RADIOLOGICAL SECTION, BALTIMORE CITY MEDICAL SOCIETY
Secretary, Dr. W. B. Firor, 1100 N. Charles St., Baltimore. Meets third Tuesday each month, September to May.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, E. N. Liljedahl, Los Angeles, Calif. Meets on the fourth Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. H. J. Walton, 104 W. Madison St., Baltimore, Md. Annual meeting, St. Louis, Mo., Nov. 19–22, 1935.

BROOKLYN ROENTGEN RAY SOCIETY
Secretary, Dr. E. Mendelson, 120 E. 19th St., Brooklyn, N.Y. Meets monthly on first Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St., Buffalo, N.Y. Meets second Monday of each month except during summer months, place of meeting selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. R. G. Willy, 1138 N. Leavitt. Meets second Thursday of each month October to May inclusive at the Palmer House.

CINCINNATI RADIOLOGICAL SOCIETY
Secretary, Dr. H. G. Reineke, General Hospital, Cincinnati, Ohio. Meets third Monday of each month, October to May, inclusive.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Otto Glasser, Cleveland Clinic. Meetings are held at 6:30 P.M. at the Cleveland Chamber of Commerce Club rooms on the fourth Monday of each month from October to April, inclusive.

DENVER RADIOLOGICAL CLUB
Secretary, Dr. K. D. A. Allen, 452 Metropolitan Building, Denver, Colorado. Meets on any month having a fifth Monday.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. E. R. Witwer, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne Country Medical Society Building.

FLORIDA STATE RADIOLOGICAL SOCIETY
Secretary, Dr. Gerard Raap, Miami, Florida. Meetings held twice a year, May and November.

ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. W. Grote, 219 N. Main St., Bloomington, Ill. Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind. Meeting held the second Sunday in May annually.

LONG ISLAND RADIOLOGICAL SOCIETY
Secretary, Dr. M. Dannenberg, 1464 Eastern Parkway, Brooklyn, N. Y. Meets on third Thursday of each month from October to May, at 8:30 P.M.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS
Secretary, Dr. S. W. Donaldson, St. Joseph's Mercy Hospital, Ann Arbor, Mich. Three meetings a year, Fall, Winter, and Spring.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. S. A. Morton, Columbia Hospital, Milwaukee, Wis. Meets monthly. Place of meeting designed by the president.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L. G. Rigler, University Hospital, Minneapolis, Minn.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass. Meets monthly on third Friday, Boston Medical Library.

RADIOLOGICAL SOCIETY OF NEW JERSEY
Secretary, Dr. P. S. Avery, New Brunswick, N. J. Meets annually at time and place of State Medical Society. Mid-year meetings at place designated by the president.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. E. F. Merrill, 30 W. 59th St., New York. Meets monthly on third Monday, New York Academy of Medicine, at 8:00 P.M.

NORTH CAROLINA ROENTGEN RAY SOCIETY
Secretary, Dr. Major Fleming, Rocky Mount, N. C. Annual meeting at time and place of State Medical Society. Mid-year scientific meeting at place designated.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. C. F. Potter, 820 S. Crouse Ave., Syracuse, N.Y. Three meetings a year—January, May, and November.

PACIFIC ROENTGEN CLUB
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. L. E. Wurster, Williamsport, Pa.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas Loughery, Germantown Hospital. Meeting first Thursday of each month from October to May inclusive, at 8:15 P.M., in Thompson Hall, College of Physicians, 19 S. 22d St.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N.Y.
Secretary, Dr. W. W. Fray, Strong Memorial Hospital. Meets monthly on second Thursday from October to May, inclusive, at 7:45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN RAY SOCIETY
Secretary, Dr. P. C. Schnoebelen, Missouri Bldg., St. Louis, Mo. Meets first week of each month. Time and place of meetings designated by president.

SOUTH CAROLINA X-RAY SOCIETY
Secretary, Dr. R. B. Taft, 105 Rutledge Ave., Charleston. Meets at time and place of South Carolina State Medical Association.

TENNESSEE RADIOLOGICAL SOCIETY
Secretary, Dr. F. B. Bogart, 311 Medical Arts Bldg.

* Secretaries of Societies not here listed are requested to send the necessary information to the Editor.

Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary-Treasurer, Dr. J. H. Smith, Lubbock, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

University of Michigan Department of Roentgenology Staff Meeting
Secretary, Dr C. B. Peirce, University Hospital, Ann Arbor, Mich.
Meets each Monday evening from September to June, at 7 p.m. at University Hospital.

University of Wisconsin Roentgen Club
Secretary, Dr. E. A. Pohle, 1300 University Ave, Madison, Wis.
Meets monthly on last Thursday, October to April, Service Memorial Institute, at 4:30 p.m.

Virginia Roentgen Ray Club
Secretary, Dr. V. W. Archer, University Hospital, University, Va.
Meets annually in October.

Cuba

Sociedad Cubana de Radiologia y Fisioterapia
Secretary, Dr. Francisco Padron, Enrique, Villuendas 64, Havana, Cuba. Meets monthly in Havana.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 p.m., at 32 Welbeck St., London, W. 1, or as advertised.

Electro-Therapeutic Section of the Royal Society of Medicine (Confined to Medical Members)
Meets on the third Friday of each month during the winter at 8:30 p.m. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

Section of Radiology and Medical Electricity, Australasian Medical Congress
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Radiological Section of the Victorian Branch of the British Medical Association
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

Section on Radiology, Canadian Medical Association
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

Radiological Section, New Zealand British Medical Association
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch. Meets annually.

Continental Europe

Belgian Society of Roentgenology
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

Société de Radiologie Médicale de France
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Société Suisse de Radiologie (Schweizerische Röntgen-Gesellschaft)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

Société Francaise d'Electrothérapie et de Radiologie Médicale.
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Association of German Roentgenologists and Radiologists in Czecho-Slovakia
Secretary, Dr. Walter Altschul, German University, Prague, II.52.

Deutsche Röntgen-Gesellschaft (Gesellschaft für Röntgenkunde und Strahlenforschung)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

Süd- und Westdeutsche Röntgengesellschaft
Meets annually in different cities.

Nord- und Ostdeutsche Röntgengesellschaft
Meets annually in different cities.

Dutch Society of Electrology and Roentgenology
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

Societa Italiana Radiologia Medica
Secretary, Professor M. Ponzio, University of Turin, Turin.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Virgil Ionescu, B-dul Schitu Măgureanu 49, Bucarest.
Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly, first Monday at 8 o'clock State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

Polish Society of Radiology
Secretary, Dr. Jan. Kochanowski, 45 Gornoslazka St., Warsaw. Meets annually.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with exception of the Denmark Society, meets every second month except in the summertime.

Society of Medical Radiology in Sweden
Meets in Stockholm.

Society of Medical Radiology in Norway
Meets in Oslo.

Society of Medical Radiology in Denmark
Secretary, Dr. G. Biering, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

Society of Medical Radiology in Finland
Meets in Helsingfors.

Vienna Roentgen Society
Meets first Wednesday of each month, at 6.30 p.m. at Zentral-Röntgen Institut des allgemeinen Krankenhauses Alserstrasse 4.

Orient

Japan X-Ray Association
c/o Orthopedic Surgery, Tokyo Imperial University.
Meets annually in April.

Kinki Roentgen-Abend Society
Director, Dr. Prof. Taiga Saito, Ogawaoike Tyoto, Japan. Meets bi-monthly on third Sunday.

SCIENTIFIC PROGRAM
OF THE
THIRTY-SIXTH ANNUAL MEETING
OF THE
AMERICAN ROENTGEN RAY SOCIETY, SEPTEMBER 24–27, 1935
HADDON HALL, ATLANTIC CITY, NEW JERSEY

TUESDAY MORNING, SEPTEMBER 24, 1935

9:00 A.M.

Call to Order. George W. Grier, M.D., President.

Presentation of medals and certificates.

Installation of incoming President.

President's Address. Fred M. Hodges, M.D.

9:30 A.M.

Symposium on Lymphoblastoma

1. Roentgenological manifestations. Carleton B. Peirce, M.D., Ann Arbor, Mich. (15 min.)
2. Roentgen therapy. Harold W. Jacox, M.D., Ann Arbor, Mich. (15 min.)
3. Unusual manifestations of lymphoblastoma and their treatment. A. U. Desjardins, M.D., Rochester, Minn. (15 min.)

   Discussion on the above papers to be opened by F. W. Konzelman, M.D., Philadelphia, Pa.
4. What the radiologist should know about clinical pathology. Karl Kornblum, M.D., Philadelphia, Pa. (15 min.)

   Discussion to be opened by F. W. Konzelman, M.D., Philadelphia, Pa.

Adjournment at 11:30 A.M. for special study of Scientific Exhibits

TUESDAY AFTERNOON, SEPTEMBER 24, 1935

2:00 P.M.

1. Malignant lymphangitis of the skin mistaken for radiodermatitis. G. E. Pfahler, M.D., Philadelphia, Pa. (15 min.)

   Discussion to be opened by E. Case, M.D., Philadelphia, Pa.
2. The relation of the endocrine system to malignancy, C. L. Martin, M.D., Dallas Texas. (15 min.)

   Discussion to be opened by Richard Dresser, M.D., Boston, Mass.
3. The place of radiation in the treatment of cerebellar medulloblastomas. Elliott C. Cutler, M.D., Merrill C. Sosman, M.D., and Walter W. Vaughan, M.D., Boston, Mass. (15 min.)

   Discussion to be opened by C. G. Dyke, M.D., New York City.
4. Some discrepancies and pitfalls that occur in clinical work as the result of the grading of tumors. F. W. Konzelman, M.D., Philadelphia, Pa. (15 min.)

   Discussion to be opened by F. W. Stewart, M.D., New York City.
5. Treatment of cancer of the skin by high voltage roentgen rays. Richard Dresser, M.D., Boston, Mass. (15 min.)

   Discussion to be opened by B. P. Widmann, M.D., Philadelphia, Pa.
6. Five year cure of mammary carcinoma with multiple metastases to bone. Wright Clarkson, M.D., and Allen Barker, M.D., Petersburg, Va. (10 min.)

   Discussion to be opened by Jacob H. Vastine, M.D., Philadelphia, Pa.
7. Liver extract as a specific remedy for roentgen sickness. Barton Young, M.D., Philadelphia, Pa. (10 min.)

   Discussion to be opened by John T. Murphy, M.D., Toledo, Ohio.
8. Lost and found radium. Robert B. Taft, M.D., Charleston, S.C. (10 min.)

   Discussion to be opened by G. E. Pfahler, M.D., Philadelphia, Pa.

4:30 P.M. BUSINESS SESSION

Tuesday Evening, September 24, 1935

8:00 P.M.

Caldwell Lecture. J. Shelton Horsley, M.D., Richmond, Va.

Wednesday Morning
September 25, 1935

9:00 A.M.

1. Blood vessel markings in the dorsal vertebrae simulating fracture. Kenneth Davis, M.D., Los Angeles, Calif. (15 min.)
   Discussion to be opened by George Wagoner, M.D., Philadelphia, Pa.
2. The diagnosis of tumors of the spinal cord. Cornelius G. Dyke, M.D., New York City. (15 min.)
3. Healing of fractures of the skull. Robert G. Vance, M.D., Boston, Mass. (15 min.)
   Discussion to be opened by W. H. Steward, M.D., New York City.
4. Study of the synovial membranes in various types of arthritis by differential stains. Ralph K. Ghormley, M.D., Rochester, Minn. (15 min.)
   Discussion to be opened by W. E. Chamberlain, M.D., Philadelphia, Pa.
5. Subchondral necrosis of the sacroiliac joints. Edwin N. Cleaves, M.D., Boston, Mass. (15 min.)
   Discussion to be opened by Arthur B. Gill, M.D., Philadelphia, Pa.

Adjournment at 11:30 A.M. for special study of the Scientific Exhibits

Wednesday Afternoon
September 25, 1935

2:00 P.M.

1. Present additional treatment with roentgen rays in carcinoma of the cervix and protracted roentgen therapy of the pelvis. Docteur Henri Coutard, Paris, France.
2. Care and treatment of sarcoma of the soft tissues. Ira I. Kaplan, M.D., New York City. (15 min.)
   Discussion to be opened by F. W. Stewart, M.D., New York City.
3. Radiotherapy in ophthalmology. G. E. Richards, M.D., Toronto, Ont. (15 min.)
   Discussion to be opened by E. W. Spackman, M.D., Philadelphia, Pa.
4. Radiation treatment of inoperable abdominal malignancy. E. A. Merritt, M.D., Washington, D.C. (15 min.)
   Discussion to be opened by Charles A. Waters, M.D., Baltimore, Md.
5. Late effects of thymus irradiation. Elizabeth Rose, M.D., and Stewart Polk, M.D., Philadelphia, Pa. (15 min.)
6. Report of series of thyroid cases treated recently. John Harris, M.D., and Edward Rose, M.D., Philadelphia, Pa. (15 min.)
   Discussion to be opened by Edgar M. McPeak, M.D., Washington, D.C.
7. Further work on the biological effect of different wave lengths. Paul C. Hodges, M.D., Chicago, Ill. (15 min.)
   Discussion to be opened by Charles Packard, M.D., New York City.

Thursday Morning, September 26, 1935

9:00 A.M.

Symposium on Research Work on the Small Intestines

1. Influence of chemistry on the motility of intestinal contents. T. Grier Miller, M.D., and William G. Karr, M.D., Philadelphia, Pa. (15 min.)
2. Influence of morphine and sulphate on the small intestines. W. Osler Abbott, M.D., and Eugene P. Pendergrass, M.D., Philadelphia, Pa. (15 min.)
3. Influence of various foods on the small intestines. I. S. Ravdin, M.D., and Eugene P. Pendergrass, M.D., Philadelphia, Pa. (15 min.)
4. The effect of calcified lymph nodes on motility in the small intestines. Ross Golden, M.D., New York City. (15 min.)
   Discussion to be opened by Lester Levyn, M.D., Buffalo, N.Y.

5. Roentgen demonstration of bleeding duodenal ulcers. A. O. Hampton, M.D., Boston, Mass. (15 min.)
   Discussion to be opened by T. Grier Miller, M.D., Philadelphia, Pa.

Adjournment at 11:30 A.M. for special study of Scientific Exhibits

THURSDAY AFTERNOON
SEPTEMBER 26, 1935

2:00 P.M.

1. Treatment of carcinoma of the prostate. B. S. Barringer, M.D., New York City. (15 min.)
   Discussion to be opened by Albert Bothe, M.D., Philadelphia, Pa.
2. Treatment of cancer of the bladder by divided doses of roentgen rays at long distances. R. S. Ferguson, M.D., New York City. (15 min.)
   Discussion to be opened by Albert Bothe, M.D., Philadelphia, Pa.
3. Radiation at long distances. Edith Quimby, M.S., New York City. (15 min.)
   Discussion to be opened by Harriet T. McIntosh, M.D., New York City.
4. Filters. G. Failla, Ph.D., New York City. (15 min.)
5. Comparison of certain filters in the 500 kv. range. K. E. Corrigan, Ph.D., Detroit, Mich. (15 min.)
   Discussion of the above two papers to be opened by Otto Glasser, Ph.D., Cleveland, Ohio.

4:30 P.M. BUSINESS SESSION

FRIDAY MORNING, SEPTEMBER 27, 1935

9:00 A.M.

1. Pelviography. Paul C. Swenson, M.D., and Howard Moloy, M.D., New York City. (15 min.)
   Discussion to be opened by R. P. Ball, M.D., Chattanooga, Tenn.
2. The physiological changes occurring in the urinary tract during pregnancy. Henry Walton, M.D., Baltimore, Md. (15 min.)
   Discussion to be opened by Alexander Randall, M.D., Philadelphia, Pa.
3. Roentgenographic studies of a new metabolic disease. Sherwood Moore, M.D., St. Louis, Mo. (15 min.)
   Discussion to be opened by John W. Pierson, M.D., Baltimore, Md.
4. The practical value of epiphysography in the diagnosis of pre-adult endocrine disorders. D. M. Clark, M.D., Santa Barbara, Calif. (15 min.)
   Discussion to be opened by E. C. Vogt, M.D., Boston, Mass.
5. Hereditary occurrence of enlarged parietal foramina. O. H. Perry Pepper, M.D., Philadelphia, Pa. (15 min.)
   Discussion to be opened by M. C. Sosman, M.D., Boston, Mass.
6. Roentgenological and anatomical study of the maxillary sinus. Oscar V. Batson, M.D., and LeRoy M. Ennis, M.D., Philadelphia, Pa. (15 min.)
   Discussion to be opened by George Coates, M.D., Philadelphia, Pa.
7. Congenital air cystic disease of the lung. B. R. Kirklin, M.D., Rochester, Minn. (15 min.)
   Discussion to be opened by Kennon Dunham, M.D., Cincinnati, Ohio.
8. The roentgen criteria for the operability of lung tumors. C. B. Rabin, M.D., New York City. (15 min.)
   Discussion to be opened by Leopold Jaches, M.D., New York City.

FRIDAY AFTERNOON, SEPTEMBER 27, 1935

2:00 P.M.

1. The value of oral examinations and the correlation of variation in density with actual pathology as revealed by operative tissue material in 2,000 gallbladder cases. Fred Jenner Hodges, M.D., Ann Arbor, Mich. (15 min.)
   Discussion to be opened by I. S. Ravdin, M.D., Philadelphia, Pa.

2. The differential diagnosis of tumefactive processes in the large intestines. Harry M. Weber, M.D., Rochester, Minn. (15 min.)
   Discussion to be opened by Ross Golden, M.D., New York City.
3. Characteristics of x-ray equipment at voltages in excess of 200,000. M. J. Gross, Chicago, Ill. (15 min.)
   Discussion to be opened by Lauriston S. Taylor, Ph.D., Washington, D.C.
4. Comparative clinical value of superhigh voltage roentgen therapy. T. Leucutia, M.D., Detroit, Mich. (15 min.)
5. Measurements and experiences with the 800 kv. tube. Howard E. Ruggles, M.D., San Francisco, Calif. (15 min.)
6. Preliminary report on the results of 800 kv. therapy. C. B. Ward, M.D., Seattle, Wash. (15 min.)
   Discussion to be opened by Francis Carter Wood, M.D., New York City.
7. Inaccuracy of the thimble chamber at more than 200 kv. Lauriston S. Taylor, Ph.D., Washington, D.C. (15 min.)
8. Induced ultraviolet fluorescence and its release by visible light. Otto Glasser, Ph.D., Cleveland, Ohio. (15 min.)

FINAL ADJOURNMENT

MID-SUMMER RADIOLOGICAL CONFERENCE IN THE ROCKY MOUNTAINS*

SPONSORED BY THE DENVER RADIOLOGICAL CLUB, SHIRLEY-SAVOY HOTEL, DENVER, COLORADO, AUGUST 28–30, 1935

ALL SESSIONS IN THE VENETIAN GARDEN

This summer the Radiological Club of Denver is attempting a new venture in sponsoring a Radiological Conference for August 28, 29, and 30. Radiologists as well as other members of the medical profession in the Rocky Mountain Region have felt the hardship in attempting to attend the various national meetings which are usually held at considerable distance, and particularly in the East. A majority of the profession find it impossible to attend these meetings and therefore lose touch with the progress of medicine. It has been observed that every summer there are a number of distinguished men who spend their vacation in Colorado. If given the opportunity these men are usually willing to present some of their recent work. For several years the Colorado Ophthalmological Society and the Colorado Society of Oto-laryngology have taken advantage of this situation in conducting a two-weeks course of teaching. These meetings have been very successful and have become well known.

The Denver Radiological Club will not offer any course of teaching but they will make it possible for radiologists and other members of the medical profession to meet and become acquainted with the work of some of the distinguished men in radiology. Among these guests will be Dr. B. H. Orndoff, Chicago, Secretary of the American College of Radiology; Dr. W. Edward Chamberlain, Philadelphia, Professor of Radiology at Temple University; Dr. J. M. Martin, Dallas, Texas, Professor of Radiology at Baylor University; and Dr. Henry J. Ullmann, Santa Barbara, California, Director of Cancer Research, Santa Barbara Cottage Hospital.

* A complete program including summary of all papers will be mailed upon request to the Denver Radiological Club, Shirley-Savoy Hotel, Denver, Colorado. No registration fee. Hotel reservations should be requested in advance of the meeting.

ORDER OF PROGRAM

WEDNESDAY EVENING, AUGUST 28, 1935

8:00 P.M.

Joint meeting with the Medical Society of the City and County of Denver. Guest Speakers:
W. Edward Chamberlain, M.D., Philadelphia, Pa.
H. J. Ullmann, M.D., Santa Barbara, Calif.

THURSDAY MORNING, AUGUST 29, 1935

9:00 Address of Welcome. Frederick E. Diemer, M.D., President of the Denver Radiological Club.
9:15 Symposium on Neoplastic Disease. Chairman: Harry Finney, M.D., Denver, Colo.
9:30 Treatment of skin and lip malignancies. H. J. Ullmann, M.D., Santa Barbara, Calif.
10:15 Radiation therapy in the treatment of carcinoma of the intraoral cavity, larynx and pharynx. J. M. Martin, M.D., Dallas, Texas.

11:00 Treatment of advanced malignancy. Sanford Withers, M.D., Denver, Colo.
11:30 Discussion opened by John M. Foster, Jr., M.D., Denver, Colo.
11:45 General discussion.
12:30 Special luncheon.
Talks by the Scientific Exhibitors.
1:00 Round table discussion on problems in radiation therapy. Sanford Withers, M.D., presiding.
Presentation of therapy problems to be answered by distinguished guests.

Thursday Afternoon, August 29, 1935

2:00 Symposium on Gastrointestinal Disease. Chairman: J. N. Hall, M.D., Denver, Colo.
2:15 Further discussion of the relation of the antrum and cap to the gallbladder as factors in emptying the gallbladder. Nathan B. Newcomer, M.D., and Elizabeth Newcomer, M.D. Denver, Colo.
2:45 Peptic ulcer. Ernst A. Schmidt, M.D., Denver, Colo.
3:15 Discussion opened by T. D. Cunningham, M.D., Denver, Colo.
3:30 General discussion.
4:00 Biopsy and x-rays in the diagnosis of intrauterine conditions. Benjamin H. Orndoff, M.D. Chicago, Ill.
4:45 Discussion opened by Lyman W. Mason, M.D., Denver, Colo.

Thursday Evening, August 29, 1935

7:00 Informal Banquet. $2.00 per plate.
Frederick E. Diemer, M.D., presiding.
"Sunlight and Shadow." Harmon P. Brandenburg, M.D., Hunter-Photographer, Denver, Colo.

Friday Morning, August 30, 1935

9:15 Symposium on Pulmonary Disease. Chairman: Henry Sewall, M.D., Denver, Colo.
9:30 Cystic disease of the lungs. L. R. Moore, Major, M.C., Denver, Colo.
10:00 Roentgen evidence of infection in region of diaphragm. Leonard G. Crosby, M.D., and Samuel B. Childs, M.D., Denver, Colo.
10:30 Inception of adult tuberculosis. Kenneth D. A. Allen, M.D., Denver, Colo.
11:00 Differential diagnosis between pulmonary tuberculosis and non-tuberculous disease of the lungs. W.W.Wasson, M.D., Denver, Colo.
11:30 Discussion opened by Cicero L. Lincoln, M.D., Denver, Colo.
11:45 General discussion.
12:30 Special luncheon.
Short talks by the Commercial Exhibitors.
1:00 Round table discussion of diagnostic problems. W. W. Wasson, M.D., presiding. Presentation of diagnostic problems for discussion by distinguished guests.

Friday Afternoon, August 30, 1935

2:00 Symposium on the Spine: Embryology, Anatomy, Anomalies and Injuries. Chairman: Hamilton I. Barnard, M.D., Denver, Colo.
2:15 Development of the vertebrae and intervertebral discs in their relation to pathology, trauma and anomalies. F. B. Stephenson, M.D., Denver, Colo.
2:45 Congenital anomalies of the spine. John S. Bouslog, M.D., Denver, Colo.
3:30 The radiologist's part in the problem of low back pain. W. Edward Chamberlain, M.D., Philadelphia, Pa.
4:15 Discussion opened by George K. Cotton, M.D., Denver, Colo.
4:30 General discussion.
4:45 What conservatism can do in the repair of certain misplaced fractures. Samuel B. Childs, M.D., Denver, Colo.
5:15 Discussion.

THE COMMERCIAL EXHIBIT

The manufacturers have evinced their customary interest in exhibiting their apparatus at the coming meeting of the American Roentgen Ray Society in Atlantic City. The Commercial Exhibit will be held in various rooms on the Thirteenth Floor of Haddon Hall, which is the same floor on which the scientific sessions will be conducted. Those attending the meeting will therefore have an ample opportunity to visit the booths and it is urged that everyone make a special effort to see all of the exhibits, and talk with the various representatives. The following manufacturers have reserved space: Adlanco X-Ray Corporation, New York City; Buck X-Ograph Company, St. Louis, Mo.; Dupont Film Mfg. Corporation, New York City; Eastman Kodak Company, Rochester, N. Y.; General Electric X-Ray Corporation, Chicago, Ill.; Kelley-Koett Mfg. Company, Covington, Ky.; Patterson Screen Company, Towanda, Pa.; Phillips Metalix Corporation, New York City; Picker X-Ray Corporation, New York City; Standard X-Ray Company, Chicago, Ill.; C C Thomas, Springfield, Ill.; Victoreen Instrument Company, Cleveland, Ohio; Westinghouse X-Ray Company, Long Island City, N. Y.; Machlett Laboratories, Springdale, Conn.

REDUCED RAILROAD FARES TO THE MEETING

The railroads have allowed the members of the American Roentgen Ray Society and their families attending the meeting in Atlantic City, September 24 to 27, 1935, a reduced rate of fare and one-third of the current one way first class fares on the certificate plan, provided 100 or more certificates are presented. Members attending the meeting are urged to secure these certificates when purchasing their railroad tickets.

MINNESOTA RADIOLOGICAL SOCIETY

The Minnesota Radiological Society held its annual meeting in connection with the Minnesota State Medical Association at Minneapolis, June 24, 1935. Dr. Percy Brown delivered an informal address on "Historical Reminiscences in the Development of Roentgenology" and following this gave a demonstration of the collection of roentgen-ray tubes. The annual Carman Lecture was delivered by Dr. Percy Brown before the State Medical Association, his subject being, "The Inception of Fluoroscopy in the United States and Carman's Influence Upon It."

The following officers for the coming year were elected: President, Dr. Eugene T. Leddy, Rochester; Vice-President, Dr. J. Richard Aurelius, St. Paul; Secretary-Treasurer, Dr. Leo G. Rigler, Minneapolis.

GOLF TOURNAMENT

A Golf Tournament will be held in connection with the coming meeting of the American Roentgen Ray Society at Atlantic City. This will take place on Monday, September 23, at Northfield. There will be eighteen hole and thirty-six hole events and in order to participate in the prizes, a player must stay for dinner after the tournament.

Members are advised to obtain playing privileges through Haddon Hall if they wish to play golf prior to the day of the tournament.

APPEAL TO THE ROENTGENOLOGISTS OF ALL NATIONS

The fortieth anniversary of the discovery of the roentgen rays comes in 1935 and we wish to fulfill a solemn obligation. We wish to commemorate with gratitude and to venerate all scientists, physicians, physicists, technicians and nurses who were pioneers in roentgenology and who lost their lives for the welfare of mankind in the service of their science. These men and women from every nation joined their hands in a mighty dance of death, having paid for the loyalty to their profession and their love of mankind with excruciating suffering and painful death while in common striving for knowledge and in emulation of the highest human ideals.

Lest we, who benefit from their scientific and medical accomplishments, should forget, we wish to immortalize them in *Strahlentherapie* by publishing a photograph and biography of each man or woman who died on the field of scientific honor in the battle against the diseases of mankind.

Each nation has made some contribution to this chapter of human heroism. We therefore sincerely request that roentgenologists from every country send to the editor of *Strahlentherapie* as soon as possible a photograph and short biographical sketch of about two typewritten pages of any of these pioneers in roentgenology whom they have known intimately.

Hans Meyer
Editor, *Strahlentherapie*
73 Parkallee
Bremen, Germany

A METHOD FOR DETERMINING THE LIMITS OF SAFETY IN ROENTGENOGRAPHY*

By ANDREW TURNBULL, M.D.
Fellow in Radiology, The Mayo Foundation
and
EUGENE T. LEDDY, M.D.
Section on Therapeutic Radiology, The Mayo Clinic
ROCHESTER, MINNESOTA

IN A busy roentgenologic department, where numerous roentgenoscopic examinations are carried out and often supplemented by roentgenograms for confirmation of the diagnosis or for record, it is possible that the total exposure, which is received by the patient in the course of the roentgenologic examination, may approach the erythema dose or even exceed it. For example, a patient may be subjected to a roentgenoscopic examination of the stomach, which is frequently followed by roentgenographic examination of the lower part of the gastrointestinal tract, the gallbladder, and perhaps the kidney and spine as well. In this extensive roentgenologic examination, which is not exceptional, the last series of roentgenograms may be a source of worry to the technician who makes them, as he fears that the exposures may produce injury. From a study of the recent roentgenologic textbooks and journals, one can obtain but little definite information, and no description of an easy method by which the limits of safety in roentgenography can be ascertained with any precision. In order to determine the approximate number of roentgenograms that can be made with safety to the patient with modern apparatus, films, and screens, we have used a method which is available in all well equipped roentgen-ray departments, that of determining by means of a roentgenometer the roentgenographic "threshold doses" in roentgens as the basis of calculation of the number of films that may be made.

It might be said, in passing, that we also used a photographic method for the determination of the intensity of roentgen rays in diagnostic exposures. But it was far less convenient to use than the previous method because of the great difficulty of getting standard and test films of suitable blackness to read by the photolometer and also because the intensities in question allowed much chance of error in making the standard ladder. In our experience the ionization method of dosimetry is easier to use and gives more consistent and dependable results than the photographic method.

We have studied the roentgenoscopic techniques and the techniques employed in roentgenography of the teeth, sinuses, kidney, ureters, bladder, colon, gallbladder, stomach, and chest. Since it is obviously impossible to have one technique for taking a roentgenogram of diagnostic value of each part of the body, and as it is necessary to allow for variations in the size of the patients and other factors, we have used here the exposure factors, which in the opinion of the technicians best fits the average case. If one considers that several of the technicians in the roentgenologic department of The Mayo Clinic, on whose opinion this average is based, have made more than 500,000 roentgenograms, it will be admitted that standardization of roentgenographic technique is possible without too great an error.

Because of technical difficulties, particularly the danger of ruining the roentgen tube, we did not measure directly the output of the various diagnostic machines, but we reproduced their setting on a standardized roentgen therapy machine and made ionization measurements at 16 inch target-skin distance and 5 milliamperes. We varied the kilovoltage and filter

* Read before the Minnesota Radiological Society, Rochester, Minnesota, October 13, 1934.

TABLE I

ROENTGENOLOGIC TECHNIQUES STUDIED

Examination	kv.	ma.	Filter, mm.	S.T.D. inches	Time, seconds	Roentgens[1] per exposure	Number of roentgenograms
Roentgenoscopic[1]	85	5	0.5 Al, 10 wood*	15	90[2]	45	8[3]
Teeth	80	10	1 Al	8	4	15	25
Sinuses	80	40	1 Al, 3 As.**	30	2	13	29
Pyelogram	80	30	1 Al, 3 As.	12	4	12	31
Kidneys, ureters and bladder	80	60	1 Al, 3 As.	21	3	6	62
Colon	90	60	1 Al, 1 As.	19	1	3	125
Gallbladder	90	60	1 Al, 3 As.	18	0.5	1.7	220
Stomach	95	50	1 Al, 3 As.	17	0.25	1	375
Thorax	80	500	0	72	0.05	0.4	938

* Ten millimeters of wood equal 0.5 mm. Al, as a filter with the kv. indicated.

** As. = asbestos, 3 mm. of which, with the kv. indicated, equal 1 mm. Al as filter.

[1] These values will vary on various installations.

[2] Actual time of activation of roentgen tube, not the time for examination.

[3] Twelve and a half minutes of exposure produced erythema.

according to the actual technique in question. The values of the outputs were then corrected to suit the actual distance and milliamperage of the diagnostic technique. The assumption was made that the output of the two types of machines with identical kilovoltage and current would be closely similar and would be less variable than the actual factors of roentgenographic exposures.

With these techniques we regard the threshold erythema dose as 375 roentgens. Therefore, the time which is required to produce an erythema can be obtained by dividing this figure by the number of roentgens produced with each diagnostic technique. Since the number of seconds which are required for each roentgenogram with a certain technique is known, the division of the time of erythema, by the number of seconds which are required for each roentgenogram will give the number of roentgenograms permissible with each technique. Or looking at the problem from another point of view, 375 divided by the number of roentgens per exposure will equal the number of roentgenograms which are permissible with repetition of this diagnostic exposure.

Certain corrections in the number of permissible roentgenograms must be made. In roentgenography of the skull or teeth, epilation must be avoided. Here it is advisable to reduce by a third the number of roentgenograms which can be made with safety. The same deduction applies to cases in which erythema is to be avoided at any cost. In cases in which roentgenograms of neighboring portions of the body must be made through fields of exposure which may overlap, allowance must be made for the exposure which is given to the skin in each roentgenographic field. In cases in which the erythema, with techniques similar to those we have cited, is regarded as having another value, for example 300 or 400 r, or in which the output in roentgens is different from that obtained with our techniques, these values must then be used as the basis for calculating the number of permissible roentgenograms. If more than 5 ma., which is the basis of our calculations, is used, the output at the higher milliamperage may safely be considered to be a simple multiple of the initial output. For example, the roentgen output at 100 ma. may be assumed to be twenty times greater than that at 5 ma.

The erythema time is therefore one-twentieth of the initial erythema time, and therefore one-twentieth of the number of roentgenograms can be made at 100 ma. than can be made at 5 ma. Within the limits of this investigation, granting a fixed voltage, the output of the same machine and roentgen tubes is proportional to the milliamperage in a constant number of minutes. Variations in target skin distance have to be corrected by using the law of inverse squares.

The table which we have given for the number of permissible roentgenograms is not to be regarded as having any fixed and absolute value. What we wish to point out is the application of the method of absolute dosimetry in roentgens to the determination of the limits of roentgenographic safety by establishing the value of each diagnostic exposure in terms of this internationally accepted constant.

SUMMARY

It is suggested that the value in roentgens of each diagnostic technique be divided into the erythema value of such technique to give as a quotient the number of roentgenograms permissible.

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

HEAD

Close, H. G. The incidence of adenoma of the pituitary body in some types of new growth. *Lancet*, April 7, 1934, *1*, 732–734.

The paper presents a consecutive study of 200 autopsied cases at Guy's Hospital. The cranial vault was explored in 132 males and 68 females, a fairly representative number. The term "adenoma" is defined and it may include tumors both solid and cystic.

Previous statistical data showed an incidence of 1 adenoma in every 10 cases studied, and this was most usually coincidental with the finding of a benign or malignant growth elsewhere.

In order to have accurate information they studied very carefully, serial microscopic section of 125 cases, 75 of which had new growths elsewhere in the body, and 50 for a group to be used as a control. Five of the latter group had an adenoma of the pituitary producing an incidence of 1 in 10. A striking feature of the first group was the high incidence of adenomata associated with tumors elsewhere. Carcinoma of the glands (thyroid, breast, etc.) had a 44 per cent incidence of pituitary adenomata while in adenomata of the prostate and carcinoma of the pancreas, rectum and bronchus, there was an associated incidence of 50 per cent.

Of the 200 pituitaries studied, an adenoma was found in 39. Most of the adenomata seen were too small to give rise to symptoms, although one had outgrown the pituitary fossa and yet produced no symptoms or signs.—*R. A. Berger.*

van Acken, Franz. Die Sutura frontalis im Röntgenbilde. (The roentgen appearance of the frontal suture.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 133, *48*, 209–222.

The author summarizes the anatomical development and obliteration of the frontal suture. The non-calcified suture can be diagnosed roentgenologically, but it is not possible to state whether the suture is still developing nor the degree of calcification during its period of closure. Roentgen examination is important for demonstrating anomalies of the suture and offers information valuable from a statistical or anatomical point of view, especially in their relation to pathologic, racial and constitutional characteristics.—*E. T. Leddy.*

Haas, Ludwig. Über die Sutura frontalis persistens. (Persisting frontal suture.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 708–716.

Persistent frontal suture is important to differentiate from the sagittal sulcus, the superimposed shadow of the sagittal suture and from fracture or fissure of the frontal bone. The condition is not very uncommon. The author suggests that it be demonstrated by the usual occipitofrontal position, combined with the projection of Waters or the nuchofrontal position of his own.—*E. T. Leddy.*

Schlesinger, B. Zur Pneumographie der Chiasmaregion. (Pneumography of the chiasmal region.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 642–645.

This is a report of 2 cases in which air was introduced into the chiasmal region. The diagnostic value of the procedure is illustrated and the possibilities of further development of the method are discussed.—*E. T. Leddy.*

Egas Moniz. Physio-Röntgenologie des Blutkreislaufs im Gehirn, in den Meningen und in den übrigen Geweben des Kopfes. (The roentgenologic physiology of the circulation of the brain, the meninges and the other tissues of the head.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 398–405.

This paper discusses some of the technical aspects of cerebral arteriography as it may be applied to the elucidation of some of the obscure problems of the physiology of the brain. The author makes his injections into the common carotid artery whereas Löhr and Jacobi prefer the internal carotid, and he feels that for the demonstration of the vessels his method is the better one.—*E. T. Leddy.*

Löhr and Jacobi. Die Arteriographie und die kombinierte Enzephalarteriographie. (Arteriography and combined encephalarteriography). *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 385–397.

Arteriography was first reported by Egas Moniz in 1931. He used 23 per cent sodium iodide but because of the risks of his technique it has not been widely adopted. Löhr and Jacobi, independet of Egas Moniz and not knowing about his work, used thorotrast for similar studies, which on the basis of 350 arteriograms they feel is the method of choice. In this article there are illustrations of the findings in normal and some of the more important lesions in the brain as shown by the authors' method. —*E. T. Leddy.*

STEINHARDT, G., and LANGEN, P. Vergleichende röntgenologische und anatomische Untersuchungen am Kiefergelenk. (Comparative roentgenologic and anatomic studies of the temporomandibular joint.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 683–708.

The authors examined roentgenologically 500 cases both living and dead by the method of Parmo and one they developed themselves and checked up the findings anatomically when possible. The cases are put into five groups which they think facilitates classification and study of the lesions of this joint.—*E. T. Leddy.*

GALLAVRESI, LUIGI. Studio radiologico di alterazioni dell'interlinea articolare temporomascellare. (Roentgen study of changes in the temporomaxillary joint interline.) *Radiol. med.*, Jan., 1934, *21*, 35–44.

It is very hard to get a clear picture of this joint interline because of superposition of the shadows of the bones of the face and skull. The author describes two projections which give quite clear pictures of it, free from most of these superpositions. The first shows the interline in its sagittal plane, the other in its frontal plane. The patient lies prone with his mouth closed and his head extended so that the middle point of the line between the condyles and the most prominent part of the chin lie on the perpendicular which passes from the focus of the tube to the film. When for any reason it is impossible to extend the head of the patient sufficiently, the axis of the tube can be inclined so as to bring the central ray in the same direction with regard to the interline. A comparison of roentgenograms taken by these two projections gives a very clear idea of pathological changes in this region.

Cases are described and illustrated with roentgenograms.—*Audrey G. Morgan.*

BIGAMI, G., and SERRA, G. Appunti di tecnica sull'arteriografia encefalica. (Technical points in arteriography of the brain.) *Arch. di radiol.*, 1933, *9*, 1006–1023.

The authors review the history of roentgen examination of the brain and suggest some new points in the technique of arteriography. The contrast substance is injected into the internal carotid which is exposed by an incision along the anterior margin of the sternocleidomastoid. It is not necessary to exercise forcipressure on the external or common carotid during the injection; such pressure may injure the vessels. It is only necessary to pass a silk ligature under the vessel and raise it slightly in order to slow the circulation sufficiently for making the injection.

They have found that iodomethanosulphate of sodium (pyelofanin) is a much better contrast medium than thorotrast. They use 10 c.c. of an 80–85 per cent concentration and have had very good roentgenograms. It is so nontoxic that the examination can be repeated several times if necessary, which is impossible with thorotrast.

They find it better to use Dos Santos' pressure apparatus rather than a syringe as the rapidity and force with which the fluid is injected can be controlled. The use of the Potter-Bucky diaphragm is an advantage if a sufficiently powerful apparatus is available. They use an exposure time of 0.3 to 0.4 second with 90 kv. and 120 ma. with a focus distance of 1.20 meters.—*Audrey G. Morgan.*

GUNSETT, A., SICHEL, D., and BOUTON, E. La radiographie simple et la radiographie stéréoscopique du massif pétro-mastoidien dans le diagnostic des otites moyennes. (Simple roentgenography and stereoscopic roentgenography of the petrous mastoid portion in the diagnosis of otitis media.) *J. de radiol. et d'électrol.*, Jan., 1934, *18*, 1–20.

During the course of time three techniques have been developed for the roentgen study of the petrous mastoid portion of the temporal bone: (1) The temporo-tympanic or temporomastoid incidence, described in 1905 by Schüller of Vienna, which puts in evidence the complete pneumatic system, the sinus, the tip of the mastoid and that portion of the petrous bone which is situated between the posterior and superior lateral wall of the pyramid, the so-called subantral region. (2) The fronto-

tympanic incidence described by Mayer in 1923 which visualizes chiefly the antral portion of the petrous bone, and (3) the occipito-zygomatic incidence of Stenvers described in 1917, which evidences the tip of the pyramid, the region of the labyrinth, the internal auditory orifice, the tegmen and sometimes the semicircular canals. The first two incidences play a great rôle in the diagnosis of otitis media which forms the subject of this paper, and therefore the authors deal with them in great detail. They state that in order to be able to repeat the examination for purposes of comparison with exactly identical incidences, certain special apparatus are necessary; among these the table of Herz proved the most reliable. Stereoscopic roentgenograms form a valuable addition in the more complex cases in which the simple roentgenograms do not furnish sufficient information.

After briefly describing the roentgen findings in several more or less typical cases, the authors arrive at the following general conclusions: In acute otitis media, roentgenography with the temporo-mastoid incidence of Schüller is of prime importance. This method permits the estimation in all cases of the amount of bone destruction, and the establishment of surgical indications. The roentgen diagnosis, as a rule, encounters no difficulties. In chronic otitis media roentgenography is also of great importance but the interpretation here often becomes difficult, especially in the cases in which there is re-exacerbation, the mastoid process being entirely devoid of pneumatization. In such instances, stereoscopic examination is more valuable but diagnosis sometimes is impossible. In lesions of the antrum the fronto-zygomatic incidence of Mayer is preferred, especially when there is a focus of bone destruction. In cholesteatomas roentgenography is likewise of capital value.

The article is richly illustrated with photographs and schematic drawings showing the various positionings and incidences, as well as the Herz table, and with numerous roentgenograms of the petrous mastoid portion of the temporal bone in the types of lesions dealt with.—*T. Leucutia.*

NECK AND CHEST

Jönsson, Gunnar. A method for roentgen examination of the hypopharynx and upper air passages. *Acta radiol.*, 1934, *15*, 125–128.

Roentgen examination is of great value in cases that are hard to examine clinically, as in children, patients with lockjaw, etc. It also sometimes furnishes details that are not supplied by clinical examination. It is well to combine an examination with contrast medium and a lateral film of the neck taken without contrast medium. When the pharynx and larynx are filled with air they stand out against the surrounding soft tissues which in turn contrast with the bones of the cervical region. Therefore deviations from normal such as swelling of the soft parts and tumor can be seen.

The author has added a technical detail which makes the findings even more definite. The examination without contrast medium is carried out during Valsalva's experiment—that is, the patient is told to pinch the nostrils together with one hand and expire with a closed mouth until he feels tension in the ears. The lateral picture of the neck is taken during this experiment with the usual technique: film-focus distance 2 meters, 70 kv., 150 ma., exposure time 0.3 to 0.4 second. The method should be carried out with some caution if the patient has previously had middle ear disease as it is possible for an atrophied ear-drum to rupture during the experiment.

This technique raises the pressure in the upper air passages, distends the walls and the increased air content gives good contrast. Moreover in normal cases the hypopharynx fills with air and can be studied better than on the usual lateral film. If the hypopharynx does not distend it suggests infiltration of its walls. The soft palate is pressed forward and down and as a result the space in the nasopharynx becomes larger and it is easier to see pathological changes there. The walls of the larynx are stretched and the ventricle of Morgagni widens so that the true and false vocal cords can be distinctly seen. A clear picture of the details of the larynx can be obtained in every case by this method.—*Audrey G. Morgan.*

Mathey-Cornat, M. R. Contribution a l'étude du radio-diagnostic des tumeurs malignes du larynx et de l'hypopharynx. (Contribution to the study of the roentgen diagnosis of malignant tumors of the larynx and hypopharynx.) *Presse méd.*, March 21, 1934, *42*, 457–460.

During the past year the author has examined 50 cases of epithelioma of the larynx and

hypopharynx by means of roentgen exposure of the soft tissues of the neck at the Anticancer Institute of Bordeaux. In this article he presents 7 cases of more or less typical lesions, using roentgenograms and drawings for illustration. The cases represent epitheliomas of the hypopharynx, epiglottis, exolarynx, larynx and endolarynx. The following summary is given: The malignant tumors of the hypopharynx are diagnosed more easily than those of the larynx because they superimpose on the clear aerial column which extends from the angle of the mandible to the upper border of the thyroid cartilage. These tumors may be located on the epiglottis, glottic fold, posterior wall of the pharynx, pharyngo-arytenoid juncture or pyriform sinus. Their opacity is very evident, a fact which makes their roentgen visibility easy. The malignant tumors of the larynx are characterized roentgenologically in their first stage by projection of a dense shadow in the normally transparent aerial column, by obscuration of the fusiform clear space of the ventricle of Morgagni and in a later stage by an infiltration of the cartilages, deformity or subluxation of the normal segments and obscuration of the clear space of the larynx. The roentgen image of the endo- and exolaryngeal neoplasms, as well as of the posterior neoplasm, is characterized by pressure on the surrounding structures, especially on the esophagus. The swallowing of an opaque mixture during the taking of the roentgenogram often helps to outline the tumor in such instances indicating the level of the pressure on the esophagus. In addition, generally there is a cloudy, diffuse opacity with indefinite borders in the region of the tumor with infiltration or even destruction of the cartilage of the larynx. A differentiation from benign tumors of the pharynx and larynx is made chiefly on the basis that these latter appear more homogeneous, of sharp borders and produce no diffuse or massive infiltration of the cartilage. Attention is drawn to the fact that in old age calcification or ossification processes may obliterate the clear space of the ventricle of the larynx, this being important from the point of view of differential diagnosis.

In conclusion the author stresses that a roentgen examination of the neck with soft tissue exposure be made routinely in all cases suspicious of malignancy. The method gives much more valuable information than either laryngoscopy or pharyngoscopy, often permitting the diagnosis of malignancy in a very early stage. The method is also valuable in the periodic check-up examinations following institution of roentgen therapy, making possible a more accurate estimation of radiosensitivity of the irradiated tumor.—*T. Leucutia.*

Farinas, Pedro L. Serien-Bronchographien zur Frühdiagnose des Bronchial-karzinoms. (The early diagnosis of bronchial carcinoma by means of serial bronchography.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 330-338.

Early evidence of the presence of bronchial cancer may be obtained by bronchography with 40 per cent iodipin (Merck), the study being made in various directions under the roentgenoscope. The author uses an apparatus similar to that for studying the duodenum. He gives short histories of 15 patients and typical roentgenograms to illustrate the findings in the various types of this tumor.—*E. T. Leddy.*

Beutel, A. Zur bromchographischen Diagnostik der Bronchuspolypen. (The bronchiographic diagnosis of bronchial polyps.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 198–202.

The author gives the first description of the roentgen signs of polyp of the bronchus which was localized and its form and size determined by bronchography. Roentgen treatment reduced the stenosis of the bronchus which was total at the first examination. The author confirms the idea of Lenk that a sharp rounded contour of a bronchial polyp does not always mean that it is benign.—*E. T. Leddy.*

Vita, G. Contributo anatomo-patologico e radiologico allo studio del lobo della vena azigos e del lobo cardiaco. (Anatomico-pathological and roentgen study of the vena azygos lobe and the cardiac lobe.) *Arch. di radiol.*, 1933, *9*, 921–941.

The author had occasion to make a roentgen study of a case, controlled by autopsy, in which there was both a vena azygos lobe and a cardiac lobe on the right side, that is, the right lung had five lobes. He describes the case in detail and illustrates it with photographs and roentgenograms.

The patient died of miliary tuberculosis. Macroscopic and microscopic examination of the different lobes showed that the dissemination of tubercles in the supernumerary lobes was of the same density as in the normal lobes

Therefore the supernumerary lobes did not show any special type of reaction to the disease.

Opaque injection of the bronchial tree showed that the vena azygos lobe was supplied by a very small bronchus which was sharply curved at its beginning. This explains why the vena azygos lobe had undergone atelectasis.—*Audrey G. Morgan.*

Bottaglia, Mario. Sul lobo della vena azygos normale e patologico. (The normal and pathological vena azygos lobe.) *Arch. di radiol.*, 1933, *9*, 1082–1090.

Among 1,500 roentgenograms taken since the roentgen appearance of the vena azygos lobe has been known, the author found such a lobe in only 3 cases or 2 per 1,000. In the first case the finding was verified by autopsy. It was in a woman who had hypertrophic cirrhosis of the liver and died of acute peritonitis. The roentgenogram during life had shown the vena azygos lobe less transparent than the rest of the lung. Autopsy showed it aerated by a very small bronchus and atelectatic. The second case was in a boy of eighteen who had not had any lung disease. The different appearance of the lobe in different positions of the body is described and illustrated with roentgenograms. The third case was in a young woman of eighteen who after a right pleurisy had a localized pleurisy of the azygos interlobar fissure with opacity of the lobe itself. Two years later the roentgenogram of the lobe had become normal and only a delicate azygos line could be seen.—*Audrey G. Morgan.*

Graeser, James B., Wu, Ching, and Robertson, Oswald H. Physical signs and roentgenographic findings in lobar pneumonia in adults. *Arch. Int. Med.*, 1934, *53*, 249–268.

The authors present 40 scientifically studied cases of lobar pneumonia of adults correlating the clinical and roentgenographic aspects. All cases demonstrated a definite roentgenological change twenty-four hours after the onset of the illness. At this time very little if any change could be demonstrated by physical examination. The roentgenogram was found to be the most accurate procedure in the study of the developing lesion. Serial film study of the resolving lesion revealed changes to occur first in the areas of onset of the condition, followed later by a diminution in the process which was the last to be involved. Visceral manifestations were chiefly those of diaphragmatic displacement and was noted in eighteen of twenty-seven cases.—*R. A. Berger.*

Friedberg, Herbert. Beitrag zur Untersuchung des Zwerchfells mittels des Flächenkymogramms. (A contribution to the examination of the diaphragm by means of surface kymograms.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 630–638.

Friedberg evaluates kymography as one of the most valuable methods of examination of the diaphragm and by 10 case reports he demonstrates the superiority of this method over others, such as the ordinary roentgenogram or screen examination. Kymography permits a purely objective study of the normal and pathologic movements of the diaphragm, and therefore opens up a whole new field for roentgenologic and clinical investigation.—*E. T. Leddy.*

Hayer, E. Seltenere Formen von Zwerchfellhernien und ihre röntgenologische Erfassung. (Some of the rarer forms of diaphragmatic hernia and their roentgen recognition.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 165–176.

Hayer describes 6 cases of diaphragmatic hernia in different locations, among them a spurious congenital hernia with a great diaphragmatic defect. He also makes a critical analysis of the diagnostic points and the demonstration of the localization of the actual region of the rupture. In obscure cases pneumoperitoneum is a valuable diagnostic method. He emphasizes the danger of increased abdominal pressure in cases with great defects in the diaphragm.—*E. T. Leddy.*

Goodall, Harry W., and Hoyt, Lyman H. Thoracic stomach; report of five cases. *Arch. Int. Med.*, April, 1934, *53*, 594–614.

Five roentgenographically studied cases of thoracic stomach are presented. Symptoms of this condition are due to the result of two factors, one which embarrasses the thoracic organs and the other which interferes with the peristaltic activity of the gastrointestinal tract. Dyspnea, angina pectoris, palpitation, abdominal pain, dysphagia, nausea, and vomiting, gas and constipation are encountered. The clinical findings and the history of the cases were very suggestive, particularly in view of the experiences met with in the first case. On

screen and film examinations the esophagus was found to be shortened in all cases with a small or large portion of the stomach above the diaphragm.—*R. A. Berger.*

Tattoni, Armando. La linea capillare destra nel normale e nel patologico. (The right capillary line under normal and pathological conditions. *Arch. di radiol.*, 1933, *9*, 1103–1116.

The author discusses the various theories in regard to the significance of the right capillary line and concludes that it is the shadow of the pleural folds of the middle interlobe. It is very hard to demonstrate in normal individuals even with all sorts of variations in technique and incidence. It is seen very frequently, however, in cases with pleuropulmonary lesions and remains constant through all changes of projection and incidence. He believes that it is a subcapillary line rather than a capillary line, strictly speaking, and that it is caused by inflammatory changes in the interlobar pleural folds, even though the inflammation may be slight.—*Audrey G. Morgan.*

Ferretti, Luigi. Calcificazione pleurica post-traumatica. (Post-traumatic pleural calcifications.) *Arch. di radiol.*, 1933, *9*, 959–969.

It has been known since the time of Morgagni that calcifications of the lung may take place, but up until the roentgen era they were almost always discovered at autopsy. Since then it has been possible to study them in the living subject, though generally they do not present any characteristic symptomatology. The spots may be small, being manifested in the roentgenogram by small shadows like drops of wax or by needle-like shapes or nodular cords, or they may be larger and appear as more or less regular plaques.

The author describes a case in a man of forty-five who had been wounded in 1917. Some months later he suffered a suppuration of the right lung for which he was operated on. About two years ago he had a right bronchopneumonia which underwent resolution after about a month. Since then he had had pain in the right side of the thorax which was not very severe, and sometimes intense asthenia. The roentgenogram showed a shield-shaped plaque of calcification covering the lower two-thirds of the lung field. It was not very opaque in the center but had a border of deep opacity.

War wounds are an important factor in producing such calcifications.—*Audrey G. Morgan.*

Moga, Aurel, and Sireteanu, Modest. Consideratiuni asupra stenozei istmului în legatura cu trei cazuri. (Considerations on stenosis of the aortic isthmus in connection with three cases.) *Cluj. med.*, Jan., 1934, *15*, 15–18.

Stenosis of the aortic isthmus occurs more frequently than one would be led to believe. Clinically the diagnosis is made on the presence of collateral arterial circulation, systolic murmur which is more audible on the left second and third intercostal spaces or in the corresponding paravertebral region, and chiefly on the difference in the superior and inferior circulation, the radial pulse appearing in good condition, whereas the femoral pulse is weak and even imperceptible. Roentgenologically the following signs are of importance: (1) absent or small aortic arc of the cardiac shadow contrasting with a dilated and elongated ascending aorta; (2) invisible descending aorta, there being a sudden break in continuity from the stenosis down, the ascending aorta above the stenosis appearing more opaque because of its enlargement; (3) erosion of the ribs due to aneurysm of the intercostal arteries. Most of these signs were present in the authors' 3 cases which are described briefly in the text. This proves that roentgen examination is of decided value in the majority of the cases of stenosis of the aortic isthmus.—*T. Leucutia.*

Katzilambros, L. Die Veränderung des Herz- und Lungenschattens nach Einatmung von Amylnitrit. (Changes in the heart and lung shadows after inhalation of amyl nitrite.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 338–339.

According to the author's observations, the heart shadow is markedly decreased in size and the vessels in the hilus shadow are more distinct. Lung changes, especially cavities, are more definite. Aschoff's space stands out more plainly. Roentgen examination is made with the patient recumbent at the time of greatest tachycardia.—*E. T. Leddy.*

Kudisch, B. M. Röntgenologische Studien der Aorta. (Roentgen studies of the aorta.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 298–306.

Kudisch points out the need of standardization of roentgen studies of the aorta and of a definite nomenclature. Constitutional factors determine the type of aorta in an individual. He discusses the five signs—dilatation, elonga-

tion, curvature, folding of the arch and density of the wall—from the basis of the roentgen findings in aortic disease.—*E. T. Leddy.*

Ihre, Bengt. Röntgenkymography ad modum Stumpf as a method of examining the heart. *Acta radiol.*, 1934, *15*, 107–124.

The Stumpf slit roentgen kymograph is described and illustrated. It is possible by means of its use to make a much more detailed analysis of heart movements than by any other method. It has been in use for more than a year at St. Erik's hospital in Stockholm and a report is given of the results obtained. It has been of invaluable help in the diagnosis of pleuro-pericardial lesions and in the differential diagnosis of aneurysm and mediastinal tumor. In some cases it has been the only method by which a correct diagnosis could be made.

The results, however, did not confirm Stumpf's assumption that double serrations along the whole outline of the right auricle indicate heart disease. The author does not believe that any definite conclusions in regard to the topographical anatomy of the heart can be drawn from the configuration of the serrations. The pulsations along the right auricle have aroused special interest and careful examination has shown that the double serrations may vary considerably in the same case under different conditions.—*Audrey G. Morgan.*

Hirsch, I. Seth, and Schwarzschild, Myron. The simultaneous recording of cardiac movements and sounds by the roentgen ray (kymophonoroentgenology). *Acta radiol.*, 1934, *15*, 101–106.

In studying the details of the roentgen kymographic waves made by the multiple slit method (Stumpf) several notches or serrations were seen on the main limbs of the waves. Three of these appear in almost all records in definite positions. The significance of these notches was studied by making a roentgen kymogram of a lever whose movement represented the actual sound of the heart transmitted through a stethoscope of special construction and transformed by audion tubes and a special circuit. The apparatus is described and illustrated.

These phonokymographic records were then checked against the notches on the kymographic waves of the heart. They were found to correspond exactly. This shows that the roentgen kymogram not only records the ordinary movements of the heart but also the motor phenomena by means of which the heart sounds are produced.—*Audrey G. Morgan.*

Burke, E. M. Metastatic tumors of the heart. *Am. J. Cancer*, Jan., 1934, *20*, 33–47.

A review of 327 autopsies on definitely malignant cases showed an incidence of 4.3 per cent with metastatic involvement of the heart. Of these, the primary lesions included: epitheliomas of the larynx, esophagus, tongue and labia; melanomas; endotheliomas; lymphosarcomas; Hodgkin's disease and carcinomas of the breast or ovary. The majority of cases showed more involvement of the left side of the heart than of the right; in none of them were the valves involved, and no cardiac symptoms were observed during life. Repeated roentgenographic studies made during the course of the clinical observations failed to reveal any signs which would justify a diagnosis of heart involvement.—*A. A. de Lorimier.*

Wilson, May G. Clinical radioscopic studies of the heart in children. *Am. J. Dis. Child.*, April, 1934, *47*, 750–763.

The method used in obtaining cardiograms of the frontal plane of the cardiac silhouette for mensuration was teleradioscopy at a distance of 2 meters. Roentgenoscopic examinations in three positions, posteroanterior, left anterior and right anterior oblique were made on each subject, standard degrees of rotation being used in the oblique position; 504 children between the ages of five and fifteen years were examined. From observations of 119 normal children the following roentgenologic criteria of judging cardiac abnormality were defined:

1. On teleradioscopic examination a cardiothoracic index of more than 50 per cent and a body surface-cardiac surface area quotient of less than 14, indicating enlargement of the frontal plane of the cardiac silhouette (an enlarged right auricle, right ventricle or left ventricle, alone or combined).

2. On roentgenoscopic examination abnormal configuration of the cardiac silhouette in the anteroposterior position: abnormal pulsation at the base, marked convexity of the pulmonary conus and a straight left border, alone or combined (indicating a congenital anomaly, right ventricular enlargement).

3. In the left anterior oblique position, an angle of clearance of the left ventricle of 55°

or more, indicating left ventricular enlargement.

4. Enlargement of the left auricle: in the right anterior oblique position, posterior displacement of the esophagus; in the left anterior oblique position, enlargement seen at the angle of bifurcation of the trachea, and in the postero-anterior position, marked enlargement noted on the right lower border.

On comparison of the ability of these roentgenologic criteria to differentiate cardiac abnormality, it was shown that the roentgenoscopic examination differentiated the normal from the abnormal heart with the greatest frequency.

The author describes in detail her method and technique. Beside the 119 normal children examined, 61 were children in whom there was possible cardiac disease (without evidence of enlargement or characteristic murmur, the majority having systolic murmurs in the second left intercostal space or at the apex); 64 were subjects with potential heart disease (all of these had a past history of rheumatic fever, and many had inconstant systolic murmurs or impure first sounds at the apex); 45 were children with congenital cardiac defects, and 215 were children with chronic cardiovalvular disease.

Wilson believes that roentgenoscopic examination of the heart in children in the three standard positions is a simple, reasonably accurate roentgenologic method for recognizing cardiac abnormality; that a normal angle of clearance of the left ventricle (of less than 55°) in the left anterior oblique position would seem to be a reliable roentgenologic criterion; that this angle of clearance of the left ventricle differentiated with the greatest degree of frequency the normal from the abnormal heart, as compared with measurements of the frontal plane of the cardiac silhouette.—*R. S. Bromer.*

ABDOMEN

Colalè, Gaetano. Lo spasmo segmentario della piccola curva dell'antro pilorico nella diagnostica delle affezioni ulcerative piloro-duodenali. (Segmental spasm of the lesser curvature in the diagnosis of ulcer of the pyloroduodenal region.) *Arch. di radiol.*, 1933, *9*, 1045–1060.

The opening and closing of the pylorus is commonly supposed to be brought about by the acid chyme but recent work has shown that hydrochloric acid has practically no effect on it. It is dependent on peristalsis and the tonus of the stomach musculature. Roentgen examination shows dystonia before there are any changes in chemical secretion and a careful roentgen study of the motility of the digestive tract has shown that its movement is practically independent of secretion. Chemical action is a secondary factor and not the primary one in the production of ulcer. Contracture of the muscles causes ischemia, erosion and ulceration, after which chemical action takes place.

By means of careful roentgenoscopic examination the author has shown a segmental spasm of the lesser curvature of the stomach in the region of the antrum which is almost a pathognomonic sign of ulcer of the bulb of the duodenum. It is a tonic contracture of the lesser curvature which causes a bend at almost a right angle at the transition between the antrum and the body of the stomach. The spasm occurs almost immediately after ingestion of the contrast medium, as soon as it reaches the lesion, and is evidently due to a reflex from the ulcer. It differs from segmental rigidity of the lesser curvature in that it is functional and transitory while rigidity is anatomical and permanent. It must be looked for with great care because it is so fleeting, lasting but a few seconds. It is the most important of the indirect signs of duodenal ulcer. Two cases are described and roentgenograms of the findings given. Serial roentgenograms have to be taken in rapid succession to show it.—*Audrey G. Morgan.*

Henning, N., and Schatzki, R. Gastrophotographisches und röntgenologisches Bild der Gastritis ulcerosa. (The gastrophotographic and roentgenologic pictures of ulcerative gastritis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 177–182.

The authors report a case of ulcerative gastritis which was demonstrated gastroscopically and roentgenologically. The gastric erosions, contrary to the usual opinion, can be demonstrated roentgenologically. The picture presented is that of round or oval pea to cherry size spots with a centrally situated barium deposit (the erosion). These spots usually follow the course of the rugae which in this case were definitely enlarged. The authors think that the greater part of these erosions cannot be demonstrated roentgenologically but this case shows that they can be visualized.—*E. T. Leddy.*

Koch, C. E. Leukämische und pseudoleukämische Wandveränderungen des Magens im Reliefbild. (The appearance of the relief in leukemic and pseudoleukemic changes in the stomach wall.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 271–278.

The author reports the findings in a case of lymphatic infiltration of the stomach wall due to lymphoblastic leukemia and a case of tumor-like lymphogranulomatous hyperplasia, in both of which the appearance of the mucosal relief was very similar. There was thickening of the mucosal folds, tumor-like hyperplasia of the pylorus and irregularity of the first portion of the duodenum. These changes resemble those due to carcinoma. Koch points out as a characteristic of this lesion a gyric type of thickening of the mucosal folds.—*E. T. Leddy.*

Gutmann, R.-A. La muqueuse dans les sténoses duodénales et jéjunales. (The mucosa in the duodenal and jejunal stenoses.) *Bull. et mém. Soc. de radiol. méd. de France*, March, 1934, *22*, 157–160.

The purpose of this brief presentation is to introduce two new terms for the characterization of the mucosal appearance in stenosis of the duodenum and jejunum. It was observed that the mucosa of the dilated duodenum above the stenosis presents at the examination in thin layer an aspect which can be called "tortoise shell comb aspect," the lines of union between the scales representing the internal relief of the duodenum. The appearance is not unlike that of a hypertrophic duodenitis, but here the mucosal folds appear thicker. The second term is "Japanese lantern aspect" which is observed in grossly dilated jejunums above the site of the stenosis. The observation of these two aspects on the afferent or efferent loops of the bowel in case of gastroenterostomy might aid greatly in establishing a diagnosis of obstruction due to adhesions.—*T. Leucutia.*

Kienböck, R., and Schönbauer, L. Ein Fall von Darminvagination. (A case of intestinal invagination.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 426–430.

The patient had had symptoms of intestinal obstruction for a short time. There was a hard mass in the right abdomen. The roentgen examination led to a diagnosis of colonic stenosis with probable ileocecal invagination. Operation confirmed the diagnosis. The important roentgen findings are illustrated.—*E. T. Leddy.*

Hürthle, R. Beiträge zur Kenntnis des Duodenum inversum. (A contribution to our knowledge of duodenum inversum.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 265–270.

Hürthle reports 5 cases of duodenum inversum and duodenum inversum mobile. In 3 cases the lesion was discovered accidentally as it produced no symptoms. In 1 case there were symptoms that could be explained on a basis of obstruction in the duodenum. This lesion should be considered in cases of any indefinite gastrointestinal trouble.—*E. T. Leddy.*

Bayer, Ludwig. Das typische Röntgenbild der chronischen Dünndarmstenose. (The typical roentgen picture of chronic stenosis of the small intestine.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 192–198.

Roentgen examination in chronic ileus is without risk and is the most certain method of making the diagnosis. The author discusses and illustrates the findings in some typical cases. The signs of ileus, either singly or in combination are: (1) upward displacement of the stomach which is pushed to the right; (2) decreased secretion and increased emptying time of the stomach; (3) dilatation of the proximal intestine, occurrence of Kerkring's sign and abnormal arrangement of the coils of the small intestine, and (4) sedimentation of the contrast medium or the bowel contents and the formation of mirror-like bubbles.—*E. T. Leddy.*

Meyer, André. Diverticulose duodénale. Étude radiologique de 31 cas. (Duodenal diverticulosis; roentgen study of 31 cases.) *Bull. et mém. Soc. de radiol. méd. de France*, Jan., 1934, *22*, 48–51.

The author observed duodenal diverticulosis in 31 of his cases; that is, in 2.5 per cent. In studying these cases from various angles he was able to arrive at the following conclusions: There are two types of diverticulosis: (1) the simple and (2) the complicated type (diverticulitis). (1) The simple type is characterized by the presence of one or several diverticula without evidence of inflammatory symptoms or prolonged retention. Likewise there are no clinical disorders and the patient is free of complaint. The diverticula are observed accidentally during the course of examination for other lesions. They were found in 16 of 31 cases. (2) The complicated type represents a distinct clinical entity characterized by di-

verticular stasis, prolonged retention, secondary inflammation (diverticulitis) associated not infrequently with perivisceritis and an ulceration with vascular erosion (hematemesis). Clinically one observes (*a*) a dull pain which is more or less continuous, localized to the epigastric region just a little to the right of the midline, the pain being uninfluenced by the ingestion of food or diet; (*b*) an attenuated peritoneal syndrome consisting of difficult gastric digestion, some nausea with occasional vomiting, epigastric muscular rigidity and rarely subfebrile state, and (*c*) exceptionally hematemesis.

Differential diagnosis includes ptosis, extraduodenal ulcer, cholecystitis and cancer. The dimensions of the diverticula observed in the 31 cases varied from the size of less than a cherry pit to the size of a mandarin. They originated over the entire length of the duodenum, half of them being located around the ampulla of Vater.—*T. Leucutia.*

EDWARDS, HAROLD C. Diverticula of the duodenum and jejunum. *Lancet*, Jan. 27, 1934, *1*, 169–174.

The article classifies diverticula of the duodenum and jejunum into two groups: congenital and acquired, with various subdivisions of the two. Diverticula were found in 0.7 per cent of examined cases, or 6 in 854 examinations. This figure the author believes is too low. The most common site for the occurrence of diverticula was found to be in the second part of the duodenum. Only 9 of 27 cases presented subjective symptoms, from which the author concluded that symptomatology was variable and not at all distinctive. Symptoms were noted chiefly after taking food and characterized by "flatulent dyspepsia" and "epigastric pain." Reports of cases accompany the article. —*R. A. Berger.*

ZANETTI, S. Ulcera o diverticolo ulcerato della III porzione del duodeno. (Ulcer or ulcerated diverticulum of the third portion of the duodenum.) *Arch. di radiol.*, 1933, *9*, 1091–1102.

Most ulcers of the duodenum are in the bulb, about 90 per cent at least, and the majority of the remaining ones are in the second portion. Ulcer of the third portion of the duodenum is very exceptional.

The author describes a case in a young man of twenty-three. In his childhood he had occasionally had attacks of colic with vomiting. In the autumn of 1928 he contracted malaria and in the spring of 1929 he suffered a severe shock from earthquake. During that summer the signs of ulcer began. At first he had slight painful cramps in the abdomen, not radiating and not accompanied by vomiting. He had a feeling of weakness which was relieved by taking food. The attacks lasted a few days and between attacks he felt perfectly well. He had two or three attacks a year during 1930, 1931 and 1932. But in the autumn of 1932 they became longer and more painful and more resistant to treatment and his stools were dark and apparently contained blood. The physician who was consulted made a probable diagnosis of chronic appendicitis and ulcer of the duodenum.

Roentgen examination showed the filling of the bulb of the duodenum normal but on emptying a residual spot of barium could be seen in its central part. Examination an hour later showed a diverticulum which at first appeared to be attached to the lesser curvature of the stomach but on successive examinations in the oblique projection with manual manipulation it was found to be at the duodenojejunal angle. Pressure over this point caused pain. The appendix was fixed and very painful on pressure. On the basis of these findings a diagnosis was made of lesion of the third portion of the duodenum, probably callous ulcer, while the finding in the bulb was considered doubtful. Operation confirmed the roentgen diagnosis and showed also a fresh mucous ulcer in the bulb and a small adenofibroma.

This case furnishes a support for the theory of ascending infection as a cause of ulcer of the duodenum. The colic the patient suffered in childhood had probably been caused by the appendix. The malaria and the psychic trauma added to the disease of the appendix had created a point of least resistance at which ulcer had developed.

The symptomatology of extrabulbar ulcer of the duodenum is about the same as that of ulcer of the bulb.—*Audrey G. Morgan.*

EDWARDS, HAROLD C. Diverticula of the colon and vermiform appendix. *Lancet*, Feb. 3, 1934, *1*, 221–227.

In a six year period 621 examinations of the colon yielded 55 cases (8.9 per cent) of colonic diverticula. No cases were found below the age of thirty-five although 114 of the total exam-

inations were below this age limit. The average age incidence was found to be sixty years.

From the roentgenological standpoint the earliest sign is a pinhead sized elevation on the surface of the colon. The next stage presents a "saw edge" appearance while in the last stage one sees a series of pear or flask shaped protuberances. In the advanced state of the last stage the diverticula may assume the shape of a sphere. The appearance of all forms may be greatly modified or altered by retained fecal contents.

The incidence of diverticula of the appendix was found to be 0.53 per cent and an age average of forty-two years. Roentgenological statistics are of little value since in most cases of this condition there is some degree of obstruction in the lumen of the appendix.—*R. A. Berger.*

Piccinino, Guido. Il cieco e l'appendice studiati col clisma opaco. (Study of the cecum and appendix by means of the opaque enema.) *Radiol. med.*, Jan., 1934, *21*, 26–35.

Examination of the colon by means of opaque enema is particularly useful in giving a general view of the condition of the intestine when there is not time to follow an opaque meal throughout its passage through the intestine. The cecum and appendix can also be studied in this way if the proper technique is used. The patient should be given an oil purgative the evening before and one or two cleansing enemas given just before the examination. Three quarts of a dense opaque liquid should be given slowly. This fills the distal part of the colon up to the splenic flexure. From here it flows into the proximal part as if it were aspirated. This can be facilitated by the patient's lying on his right side and by massage. There is reflux into the small intestine in the majority of cases. This is an indication that it is not pathological but that the ileocecal valve has a sphincter action.

Ordinarily the appendix fills at the same time as the cecum, almost as frequently as it does on examination with the opaque meal. As a rule, the filling of the appendix is more homogeneous by enema. This method has special advantages over that by mouth in cases of retrocecal appendix or low appendix. In all cases the examination by enema shows not only any malformations of the appendix but also any changes in the base of the cecum, changes which may vary from simple alterations in the mucous membrane relief to complete lack of filling. These signs show that the base of the cecum is always involved in inflammation of the appendix. This opens up new possibilities in the diagnosis of chronic appendicitis, especially in cases in which the appendix does not fill with contrast.—*Audrey G. Morgan.*

Snell, Albert M., and Camp, John D. Chronic idiopathic steatorrhea; roentgenologic observations. *Arch. Int. Med.*, April, 1934, *53*, 615–629.

The authors present 7 carefully studied cases of steatorrhea (Gee's disease, adult celiac disease), commenting upon the etiology and clinical syndrome. Inasmuch as this condition is related to calcium metabolism and since calcium absorption takes place in the first part of the gastrointestinal tract, they believe that this part of the alimentary system should reveal demonstrable changes. Three of their 7 studied cases demonstrate anatomic variations in the duodenum, manifest chiefly by variations in the contour and caliber of the duodenal second portion. One case which improved under medical management also revealed definite changes roentgenologically.

Three cases had skeletal studies, 2 of which revealed bone changes, one showing osteoporosis and the other marked osteomalacia with deformities of the pelvis and long bones.—*R. A. Berger.*

Groth, Karl-Erik. The axial torsion of the colon through so-called physiological volvulus. *Acta radiol.*, 1934, *15*, 153–168.

Volvulus up to 180° is generally considered physiological, but even in these so-called physiological cases occlusion of the intestine and interference with the circulation may occur. Axial torsion of the extremities of the loop always occurs in volvulus. If this axial torsion is limited to a short stretch of the intestine, it causes occlusion while if it is distributed over a longer segment occlusion does not occur. Illustrations are given showing the effect of these different distributions of the axial torsion in a rubber tube. Illustrative cases are described of volvulus of 180° in the transverse colon and the sigmoid. A localized axial torsion is shown on the roentgenogram by transverse or spiral stripes of contrast. Localized axial torsion is to be found at the point where the mesentery of the twisted loop begins or ends. It is not

necessarily situated at the point of crossing of the ends of the loop; it may be there or it may be inside or outside the twisted loop. Whether or not axial torsion occurs depends largely on the degree of distention of the colon. If it is rather empty and collapsed axial torsion extends over a long segment and occlusion does not occur, but if it is distended with feces or flatus the torsion will remain localized and cause occlusion. Physiological volvulus may be reduced by contraction and shortening of the loop of intestine.—*Audrey G. Morgan.*

Matteucci, Eugenio. Enterolitiasi e pseudo-enterolitiasi. (Enterolithiasis and pseudo-enterolithiasis.) *Radiol. med.*, Feb., 1934, *21*, 150–158.

A child nineteen months of age was sent to the hospital for examination for suspected sarcomatosis of the abdomen. The child was very much retarded mentally and physically. Nodular masses could be felt along the course of the intestine. The child had been given prolonged treatment with irradiated ergosterin. The nodules proved on roentgen examination to be intestinal calculi. The child was taken home by his parents and nothing is known of the further course of the case. A similar case has been described by Marfan and Dordencourt in which after long continued treatment with ultraviolet rays a child passed many large intestinal calculi composed of carbonate and phosphate of calcium. The intestines of some infants contain mucous structures resulting from prenatal enteritis and any cause tending to produce calcification may transform them into calculi.

A bibliography of the subject is given.—*Audrey G. Morgan.*

Kadrnka, Silvije, and Sechehaye, Léon. Cholécystographie orale selon la méthode de Sandstroem (administration par doses fractionnées). (Oral cholecystography according to the Sandström method; administration of fractionated doses.) *J. de radiol. et d'électrol.*, Jan., 1934, *18*, 21–33.

The authors used the fractionated method of Sandström variant II (see abstracts this Journal, March, 1934, pp. 416–417) for cholecystography in a series of 56 cases. In this article the technique of procedure as well as the results obtained are described in detail, numerous roentgenograms being used for illustration. It is generally concluded that in all pathological states of the gallbladder an opacification may be obtained, the degree of which varies from complete opacity to nonfilling. It seems thus that with the exception of lithiasis, which gives the largest percentage of negative cholecystograms, the roentgen image of the gallbladder is dependent upon the intensity of the pathological process rather than its nature, the filling being the less the more diseased the organ. Concerning the reaction, the authors state that the fractionated method carries the least risk of all so that it can be undertaken even in case of more severe affections of the liver such as hepatitis and cirrhosis. The authors observed a moderate reaction in 6 of the 56 cases consisting (1) of urticarial pruriginous eruption; (2) vomiting; (3) subhepatic pain, and (4) laxative effect. None of these reactions were of any consequence.—*T. Leucutia.*

Sechehaye, Léon, and Kadrnka, Silvije. Valeur de la cholécystographie orale par administration de doses fractionnées (Sandström). (Value of oral cholecystography by the administration of fractionated doses (Sandström).) *Presse méd.*, Dec. 20, 1933, *41*, 2068–2073.

The authors in this article report their experience on 201 cases of oral cholecystography according to Sandström's fractionated method (see abstracts, this Journal, March, 1934, pp. 416–417). The following general conclusions are reached: (1) The method leads to filling of the gallbladder in all normal cases (100 per cent). The ulcerous patients always presented a normal image. (2) The negative results are due to affection of the biliary tract, 70 per cent being due to lithiasis alone. (3) A diminished opacity is observed regularly in hepatic affections (100 per cent), frequently in the affections of the biliary tract and only exceptionally in extrinsic lesions of the hepatovesicular tract (7 per cent) so that the method acquires a certain value in differential diagnosis. (4) The administration of three small doses at twelve hour intervals is well supported. The reactions are mild and rare (about 10 per cent). They consist in nausea and exceptionally in vomiting and diarrhea; the first is easily controlled by belladonna and the others by opium. The contraindications are greatly reduced. (5) The fractionated oral cholecystography is simple and gives positive results even in cases in which the intravenous method remains nega-

tive. The reverse was not observed. (6) The filling and opacity are more marked with the fractionated method than with the simple oral method or even the intravenous method (93 per cent of the gallbladders showing excellent shadows, except in hepatobiliary affections). The choledochus and the cystic duct are more frequently visualized following the eggyolk meal than with the other methods. (7) The duration of the examination, which is thirty-six hours altogether, is in reality not longer than in the other methods which also require a preparation of at least equal duration. (8) The fractionated oral method of cholecystography is superior to the single dose method either by the oral or the intravenous route. It is more harmless than the other methods and because of its simplicity is easily acceptable to the practitioner. A detailed bibliography is appended.—*T. Leucutia.*

Gilbert, René, and Demole, Michel-J. 50 cholécystographies rapides; résultats et indications. (Fifty rapid cholecystographies; results and indications.) *Presse méd.*, Nov. 18, 1933, *41*, 1823–1826.

During the past few years several cholecystographic procedures have been introduced aiming to shorten the time of the examination as a whole. The results of none of these procedures are comparable to those obtained by the method of Antonucci which is called "rapid cholecystography." As is known (see abstracts, this Journal, March, 1934, pp. 415, 416), the principle of Antonucci's method is that sugar is added to the tetraiodophenolphthalein to accelerate the appearance of the vesicular shadow. Briefly the method is as follows: (*a*) preparation of the patient for three or four days by a carbohydrate-poor diet; (*b*) on the day of examination successive intravenous injection of (1) 125 c.c. of a 40 per cent glucose solution; (2) tetraiodophenolphthalein solution; and (3) ten minutes later subcutaneous injection of 25 units of insulin. Within one-half to one hour a readable cholecystogram is obtained and within two hours the gallbladder is well visualized.

The authors have tried Antonucci's method in 50 cases by following the original technique. In this article the results are presented, the general conclusions being that rapid cholecystography is essentially a clinical method and that consequently it cannot replace the method of Sandström which has given such excellent practical results. It is felt (1) that if the physical examination indicates a lesion of the gallbladder the Sandström fractionated method will lead to best results and to least errors, whereas (2) if one suspects that the cholecystographic examination will lead to normal appearance the rapid method according to Antonucci will give the quickest and best information.—*T. Leucutia.*

Sigmund, Adolph. Les images cholécystographiques des malformations congénitales de la vésicule biliaire. (Cholecystographic images of congenital malformations of the biliary vesicle.) *J. de radiol. et d'électrol.*, March, 1934, *18*, 113–130.

The congenital malformations of the gallbladder and the biliary dyskinesias form the two more recent chapters in the ensemble of cholecystopathies. One may find in the literature a series of observations on the gross congenital anomalies of the biliary paths especially as it concerns the atresias but the alterations of form of the gallbladder are insufficiently known and the opinions concerning their clinical importance vary greatly. The author was able to demonstrate congenital deformities of the biliary vesicle rather frequently and he found an alteration of form of the gallbladder in nearly 8 per cent of all the cholecystographies. The clinical importance of such lesions is indisputable. The symptomatology varies greatly, some symptoms remaining silent despite great anatomical involvement, and others appearing quite severe and even leading to febrile icterus. It is the roentgen examination by means of cholecystography which will clarify this paradoxical behavior and therefore it should be attempted routinely in all instances. The author classifies the cholecystographic images of malformations of the biliary vesicle in the main groups on next page.

All above forms are discussed individually, numerous roentgenograms and photographs of specimens being used for illustration. In conclusion, the author considers the following two questions: (1) Is it possible to establish the limits of the normal physiologic and of the pathologic forms? There is no doubt that a change of form of the gallbladder is often observed normally but whenever such a roentgen picture is associated with a series of spastic phenomena and more or less marked functional disorders, a pathological state may be assumed. (2) Is it possible to distinguish the congenital

Congenital Malformations	Corresponding Acquired Types
1. Incisures	a. Spastic incisures b. Incisures resulting from kinking c. Incisures from swelling of the mucosa d. Incisures as a result of strangulation
2. Fishhook deformities:	
a. Simple congenital fishhook deformity	Acquired simple fishhook deformity
b. Symphysis cysto-cystica pura Symphysis cysto-cystica inflammata Symphysis cysto-cytica calculosa	Symphysis cysto-cystica inflammatoria
3. Cascade deformity	a. Cascade deformity caused by pressure b. Cascade deformity caused by inflammation
4. Hour-glass deformity	Inflammatory hour-glass deformity
5. Garland deformity	Inflammatory garland deformity
6. Mixed organic congenital diverticula	Acquired pseudo-diverticula
7. Irregular deformities	Irregular inflammatory deformities
8. Combined types	

malformations of the gallbladder from acquired inflammatory deformities? This question cannot be answered as simply. It is the author's opinion that congenital malformations of the gallbladder are encountered more frequently than the acquired deformities. Whenever the roentgen examination reveals a deformity of unknown or uncertain etiology, he therefore assumes a congenital nature. The question of differential diagnosis in these cases has not a very great practical importance.—*T. Leucutia.*

Blatter, Roland. Die Porzellangallenblase im Roentgenbild. (Porcelain gallbladder in the roentgenogram.) *Acta radiol.*, 1934, *15*, 169–177.

Calcification of the gallbladder wall is quite unusual. When it occurs it causes the roentgen picture known as porcelain gallbladder. The gallbladder picture is marbled owing to the irregular deposition of calcium. The roentgenogram is very characteristic and once seen is not apt to be confused with any other condition. Operation shows the gallbladder with thick rigid walls hard as stone. Clinically the condition does not cause any typical symptoms so roentgen examination is doubly important. The author describes 2 cases, in the first of which the patient had had indefinite stomach symptoms for some years. In the other the porcelain gallbladder was discovered by chance on examination for an inoperable carcinoma of the pylorus.—*Audrey G. Morgan.*

Buisson, Paolo. Le reazioni della cistifellea agli stimoli psichici. (The reaction of the gallbladder to psychic stimulation.) *Radiol. med.*, Jan., 1934, *21*, 44–52.

The author tried to determine whether the gallbladder responds to psychic stimuli as the stomach does. The patient had his last meal at noon; in the evening he was given the contrast injection and in the morning, ten to twelve hours later he was shown tempting foods and drinks or they were described vividly to him or he was allowed to taste them but not swallow them. Roentgenograms were taken before and after these psychic stimuli and then again after he had actually eaten food.

Roentgenograms of the findings are given. They show that the gallbladder is actually stimulated psychically. Tonus is affected as shown by changes in form and position of the gallbladder, shortening with or without increase in breadth, contraction with or without elongation, etc. Probably the function of concentration of bile is also affected as indicated by increased density of the pictures after psychic stimuli. There was no actual emptying of the gallbladder, however, under psychic stimulus; this required the actual passage of food into the duodenum.—*Audrey G. Morgan.*

Preuschoff, P. Zur Klinik und Röntgendiagnostik des vielkammerigen Echinokokkus der Leber [bei gleichzeitigem Bestehen eines Lungenechinokokkus]. (The clinical and roentgenologic diagnosis of multilocular echinococcus cyst of the liver (with simultaneous occurrence of echinococcal disease of the lungs).) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 306–314.

The superiority of the roentgen over the clinical examination in making the diagnosis of echinococcal infection of the liver is illustrated by the case reported here. The disease

was of thirty years' duration and the symptoms were those due to pressure on and displacement of neighboring organs. Roentgen examination showed markedly enlarged right and left lobes of the liver and numerous calcified areas often in a shell-like arrangement. The findings are illustrated which led to the diagnosis of hydatid disease.—*E. T. Leddy.*

Erdelyi, J. Die Wirkung grosser Papaveringaben auf die Entleerung des Magens. (The effect of the administration of large doses of papaverin on the emptying of the stomach.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 645–654.

The author reports the results of an investigation he carried out on 120 patients, for this method furnishes important information in cases of pyloric stenosis or suspected lesion of the stomach wall. By this method in 72 cases where there was a four hour residue the stomach was shown to be normal and in 5 others it showed the presence of pyloric stenosis. In cases of pyloric stenosis there may be factors which counteract the effect of papaverin, among which are the presence of a residue and hypertonia of the muscles. Many cases of pylorospasm are really pyloric hypertonia. The irritability of the stomach, irritation of the mucosa and anomalies of the muscle or mucosa may change the rate of emptying of the stomach.—*E. T. Leddy.*

Barclay, A. E. The mechanics of the digestive tract. *Lancet*, Jan. 6, 1934, *1*, 11–15.

The author describes the gastrointestinal tract as a freely movable group of viscera. When this system has its function disturbed in one place it automatically adopts another position and carries out its performance without a marked noticeable effect. He contrasts this to a machine which must always be in balance in order to operate smoothly. Therefore the gastrointestinal tract cannot be compared to a man-made object which necessarily means that the mechanics of digestion are difficult to evaluate.

By experimentation the act of swallowing was found to be the effect of a negative pressure which, when measured, was found to be equivalent to 18 inches of water. Peristalsis, on the other hand, is only a reserve mechanism and noted only with the patient in the Trendelenburg position. Gravity has only a minor part in this act.

Likewise gastric peristalsis is only a reserve force having an insignificant rôle in the propulsion of the chyme through the stomach. Material may be seen leaving the stomach in which very little evidence of peristalsis is present. The author states that the cause of the mobility of the gastric contents is not known, but he believes it is due to the tonicity of the gastric wall.

Movement of the duodenal material is not clear. The author thinks that this may best be determined by cinematographic studies.

In the small intestines the muscularis mucosa is the important factor which forces the gastrointestinal material along; while in the colon, mass movement, caused either by a rapidly progressing or a powerful peristaltic wave, is most likely the prime factor which produces the movement of the mixtures.—*R. A. Berger.*

Rivers, Andrew B. Clinical consideration of the etiology of peptic ulcer. *Arch. Int. Med.*, Jan., 1934, *53*, 97–119.

Numerous theories and hypotheses have been advanced regarding the etiology of peptic ulcer and in this article the author reviews briefly the important hypotheses concerning the genesis and course of peptic ulcer. Among the etiological agents he enumerates and discusses the following probable causes: circulatory disturbances, erosion of tissue by acid, the neurogenic factor, and inflammation and infection. The author advocates the erosion of tissue by acid as probably the prime etiologic basis. To show the importance of this factor a diagrammatic sketch is included in the form of triangles the legs of which are factors in perfect balance with one and the other. When the balance is broken in any of its component parts the possibility of ulcer formation is present. A list of 12 cases and a discussion of these is included.—*R. A. Berger.*

Palmer, Walter L., and Heinz, Theodore E. Mechanism of pain in gastric and duodenal ulcers. VII. Further observations. *Arch. Int. Med.*, Feb., 1934, *53*, 269–308.

The authors review briefly the theories for the cause of ulcer pain and supplement their findings to previously reported data. They present experimental evidence that ulcer pain arises at the site of the lesion. This pain is not directly dependent on pylorospasm, gastric motility or intragastric pressure, although it is

dependent on a stimulus acting on an irritable pain-producing mechanism located in or adjacent to the lesion itself. Irritability is enhanced by gastric acidity and the stimulus is probably exerted on the nerve ends.—*R. A. Berger.*

GYNECOLOGY AND OBSTETRICS

Albano, Giovanni. Amniosgrafia, fetografia od ovografia? (Amniography, fetography or ovography?) *Radiol. med.*, Jan., 1934, *21*, 52–56.

The author calls attention to the importance of selecting words that are accurately descriptive in naming new disease syndromes or new technical methods. He discusses the comparative merits of the words amniography, fetography and ovography in describing the process of taking roentgenograms of the amniotic cavity after the introduction of contrast medium and decides that amniography is the best term to be used.—*Audrey G. Morgan.*

Danelius, Gerhard. Das körperliche Sehen röentgenologischer Schwangerschaftsaufnahmen (The appearance of roentgenograms in pregnancy.) *Fortschr. a. d. Geb. d. Röentgenstrahlen*, 1933, *48*, 278–291.

This is a study of the spatial relationships of the position and presentation of the fetus in the uterus which can be obtained by a careful study of non-stereoscopic roentgenograms by examining the perspective shortening of the skeleton of the fetus.—*E. T. Leddy.*

GENITOURINARY SYSTEM

Lupacciolu, Giovanni. Discinesie pieloureterali e mal formazioni della colonna vertebrale. (Dyskinesias of the kidney pelvis and ureters and malformations of the spinal column.) *Radiol. med.*, Jan., 1934, *21*, 7–26.

The author reviews the literature on the subject and discusses 350 patients sent to his hospital for examination for disease of the urinary tract. Of these patients, 226 had malformations of the spinal column (lumbarization, sacralization, vertebrae with transition forms between dorsal and lumbar vertebrae, rachischisis, malformations and abnormal positions of the sacrum). Six of these patients also had malformations of the kidney, 4 kidney tuberculosis and 28 calculosis. In almost all these cases in which pyelography was performed there were functional disturbances of the pelvis and ureters (spasm, dilatation, dyskinesia) which were certainly not due to inflammation. Among the remaining 124 who did not have malformations of the spinal column 2 showed malformations of the kidney, 1 kidney tuberculosis and only 8 calculosis. In 15 cases the pain was due to appendicitis, cholecystitis, etc., and had nothing to do with the urinary tract. More than half of them had vertebral arthritis, radiculitis, etc., which explained the pain. In 75 per cent of the cases a mistaken diagnosis had been made; they did not have disease of the urinary tract.

Ten typical cases are described and illustrated with roentgenograms.

In these cases the malformation of the spinal column either caused irritation which brought about abnormal motor function of the kidney pelvis and ureter or it was associated with malformations of the nervous system with disturbed innervation of the kidney and ureter. Of course there are other factors that may bring about changes in the normal dynamics of the urinary tract, such as traumatism, abnormal composition of the urine, intoxications, endocrine disturbances, infections and internal and external compression.—*Audrey G. Morgan.*

Migliardi, Luigi. La cistouretrografia descendente. (Descending cystourethrography.) *Radiol. med.*, Feb., 1934, *21*, 136–150.

The author uses barium sulphate as a contrast medium for roentgen examination of the neck of the bladder and urethra. About 300 c.c. of the contrast fluid is introduced into the bladder with a sound; the patient stands in front of the screen with his pelvis rotated 45° and after a preliminary roentgenoscopy a roentgenogram is taken with the bladder at rest; the patient then urinates and a second roentgenogram is taken during micturition.

He has used this technique in the study of the physiology of micturition and also in the study of pathological lesions of the neck of the bladder and posterior urethra. He describes and illustrates with roentgenograms a number of the pathological conditions studied including tuberculous cystitis which often causes serious lesions of the neck of the bladder and posterior urethra.—*Audrey G. Morgan.*

Navratil, Ernst, Zur Frage der Nierenausschaltung durch Röntgenbestrahlung. (Exclusion of the kidney by roentgen irradiation.) *Strahlentherapie*, 1933, *47*, 348–358.

Klein proposed to treat ureteral fistulas by abolishing kidney function by roentgen irradiation. Weibel collected the cases from the literature and reported that cure had been effected in 13, while there had been 31 failures. Some of the cases reported as successful, however, did not prove to be so ultimately.

The author described 5 cases in which he tried this method. In 2 cases the condition was not affected, and operation had to be performed later. In 2 cases the discharge from the fistula stopped after two and five months, but it was found that in one of the cases a closed pyonephrosis had developed which had destroyed the kidney parenchyma. In the other case an intermittent hydronephrosis had developed. Therefore the irradiation could not be held responsible for the results in these cases. In 3 of these cases the kidney was diseased, and in 2 its function was almost normal. The irradiation did not have any marked effect on either the normal or diseased kidneys. In the 3 kidneys that were examined histologically afterwards there were no evidences of change caused by the irradiation. The doses used in these cases were large enough so that the failure cannot be attributed to insufficient dosage. The author concludes, therefore, that Klein's method is not to be recommended. He has used it only in cases in which operation was refused.—*Audrey G. Morgan.*

Scott, Douglas E. The part played by ureteral inflammation in dilatation of the ureter. *Arch. Surg.*, Feb., 1934, *28*, 296–306.

That dilatation of the ureter will result from obstruction is apparent, but that it may be acquired in the absence of any form of mechanical obstruction is less obvious. Russian observers have conceived the idea that atony and dilatation may result from inflammation. Braasch has repeatedly called attention to this inflammatory dilatation.

It is also true that certain obstructive factors commonly assumed to cause ureteral dilatation are in fact of obscure mechanism. Thus, there has been much speculation over the ureteral dilatation which accompanies pregnancy, and also over that which occurs with prostatic obstruction. The frequent association of these questionable obstructive factors with ureteral infection makes any appraisal of the part the latter may play a matter of interest.

This study was undertaken for the purpose of investigating these aspects of ureteral dilatation. The material investigated was obtained at necropsy in 100 unselected cases. To describe the technique of examination is unnecessary in this summary.

From an analysis of the cases it seems evident that inflammation is not an uncommon factor in ureteral dilatation. If often acts as a contributory cause, and it may be, in the absence of mechanical obstruction, the only factor in the dilatation. The effect of inflammation on the ureter is conceivably one of interference with function and atony of the ureteral wall, lessening the resistance of the ureter to pressure from within. The dilatation of inflammation has certain characteristics. It is irregular, giving an irregular ureterographic outline. It never reaches the large size often seen with obstruction. The microscopic picture is one of inflammation rather than one of muscular hypertrophy, as is often the case in obstructive dilatation.

Some of the conclusions drawn from the study are as follows:

The diameters of normal ureters may vary within wide limits, both at the widest and at the narrowest points.

The capacity of the normal ureter and pelvis in adults was found to vary from 4.5 to 20 c.c. An unusual case in which the capacity was 30 c.c. was found.

Ureteral stricture of intrinsic inflammatory origin was not found in this study.

Ureteral spasm may occur soon after death and be evident in post-mortem pyelograms.

Dilatation of the ureter can result from inflammation of the wall of the ureter in the absence of mechanical obstruction. Such dilatation presents anatomic and clinical characteristics.

Involvement of the lower part of the ureter in pelvic inflammation, by interfering with ureteral function, may cause dilatation of the upper part of the ureter and renal pelvis, without actual obstruction.

Chronic ureteritis will cause the ureteral dilatation that occurs in pregnancy to persist.

The ureteral dilatation associated with prostatic hypertrophy may have an obstructive cause, although the mechanism is as yet not clear. Ureteral inflammation is frequently a contributing factor and may be the only factor.—*W. C. Hall.*

Muir, E. G. Carcinoma of the prostate. *Lancet*, March 31, 1934, *1*, 667–672.

Muir divided his collection of prostatic carcinomata into three groups. Group I presented a prominent feature of tubule formation. Group II revealed poorly formed tubules and these were less frequent than in the former assembly. Group III included the cases in which the bulk of the growth is undifferentiated with very little evidence of tubule formation. Seventy-seven per cent of the cases had regional glandular metastases, 34 per cent visceral metastases and 28 per cent presented bone involvement, chiefly in the pelvis and lower spine. The author concluded that the average duration of life had been greatly increased by a combination of surgery, roentgen and radium therapy—*R. A. Berger.*

Rypins, Edwin L. Union of pathological fractures following metastatic hypernephroma. *Am. J. Cancer*, March, 1934, *20*, 601–605.

The author uses the term "hypernephroma" as it is used clinically, to denote tumors of the kidney regardless of the type of cell involved. He quotes various observers in expressing two outstanding characteristics of its metastases to bone: (1) the usual sparing of those portions of the skeleton distal to the elbows or the knees, and (2) the essential destructiveness of lysis of the bone architecture. The case which he reports is an exception as to both of these features: there were metastases to the ulna and to the tibia, and though irradiation was applied only to the ulna (mainly to counteract pain), both sites eventually showed signs of healing. The patient died after an interval of about six months subsequent to the latter observation.—*A. A. de Lorimier.*

NERVOUS SYSTEM

Sgalitzer, M. Beobachtung eines neuen myelographischen Symptoms. (Observation of a new myelographic symptom.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 320–323.

This is a report of a case of a woman who had had slight paralysis of the hip for ten days without fever. Myelography with iodized oil after a total block in the dorsal spine which moved downward after four days for several centimeters in a direction opposite to that expected. The rapid change of position led to rejection of the hypothesis of tumor—which could not have grown so rapidly. The author feels that displacement of lipiodol in a direction opposite to normal taking place in a short period of time points to an inflammatory process, probably with suppuration.—*E. T. Leddy.*

SKELETAL SYSTEM

Badgley, Carl E. Osteomyelitis of the ilium. *Arch. Surg.*, Jan., 1934, *28*, 83–124.

The incidence of osteomyelitis of the ilium, as compared with the incidence of osteomyelitis in general, is given as about 1 per cent by various writers on the subject. The author reports 24 cases.

The greatest incidence of osteomyelitis of the ilium is before the period of complete fusion of the epiphyses, generally before twenty-five years of age. The condition, however, may occur at any age. Michelson concluded in a report of cases that osteomyelitis of the ilium occurs less frequently in the prepuberty than in the postpuberty period.

Literature. Goullioud published the first comprehensive article on this subject in 1883. He concluded that the bones of the pelvis may be regarded as analogous to the long bones in their skeletal development and in their susceptibility to infection. He conceived that the mechanism of infection would occur in the juxta-epiphyseal zones of the pelvic bones as it does in the long bones. He divided osteomyelitis of the pelvis into two groups corresponding to developmental periods: The first period extended from infancy to puberty, at which time the three bones forming the acetabulum fuse; the second period commenced with the ossification of the acetabulum and the appearance of the marginal epiphyses, and extended to the time of fusion of the marginal epiphyses, at about twenty-five years of age. The first period was characterized by a diffuse infection almost invariably occurring at the border of the acetabulum. The second period was characterized by lesions occurring about the marginal epiphyses.

Practically all writers on this subject agree that, at operation, all diseased bone should be removed. Hence, radical resection is necessary. Von Bergmann felt that the high mortality rate occurred because the diseased area was not sufficiently excised. He recognized the rare formation of sequestrums and the frequent perforation of the tables of the ilium.

Monsaingeon in 1911 reported 14 cases. He stated that there are two main types: a subperiosteal type of lesion, and a lesion involving the growing bone area, a true osteomyelitis. The cases were subdivided into three clinical

groups: (*a*) subacute type where the lesion is circumscribed in the beginning without severe symptoms; (*b*) acute type where the primary lesion is very serious, rapidly diffuse, and often accompanied by invasion of the hip; (*c*) very acute type where the general infection dominates the picture and where the local lesion is not in proportion to the severity of the infection, very probably a true septicemia.

Geist in 1921 emphasized two important points: (1) that in his 3 cases the pus always collected in the internal iliac fossa, and (2) that sequestrum formation plays little part in osteomyelitis of the ilium. Geist advocated the trephine operation. This operation is likewise advocated by other writers on the subject.

Buonanti in 1924 reported his experiences with 4 acute cases. He emphasized the high frequency of an abscess in the internal iliac fossa, suggesting as possible factors that the pelvic periosteum perforates more easily and the iliac muscles strip more easily and the inclined plane of the pelvis tends to drain toward this fossa. He stressed the lack of spread of the infection to the viscera by continuity and gave credit to the pelvic diaphragm for preventing drainage into the true pelvis.

Development. There is a single center of chondrification for each of the three bones composing the hip bone. These centers soon fuse to produce a continuous cartilaginous hip bone which gradually assumes a definite form. A center of ossification appears in the main body of each of the cartilages, appearing first in the ilium, secondly in the ischium and lastly in the pubis. The rami of the ischium and pubis are united by bone in the seventh to eighth year. In the acetabulum the three bones composing the hip bone are separated by a Y-shaped cartilage until after puberty. The os acetabuli appears in this cartilage between the ilium and the pubis between the ninth and twelfth years. Union of the os acetabuli to the pubis occurs about puberty and soon afterward the acetabular portions of the ilium, ischium, and pubis fuse.

Two secondary ossification centers for the ilium appear at about puberty, one for the crest of the ilium, and the other for the inferior spine of the ilium. The marginal epiphysis for the crest runs from the anterior superior spine of the ilium to the posterior superior spine. These secondary epiphyses fuse somewhere between the twentieth and the twenty-fifth year.

Anatomy. There are two points of importance under this subject: first, the structure of the ilium is irregular—the thicker parts of the bone consist of cancellous tissue enclosed within two layers of compact tissue which are lined by periosteum, and the thinner parts, as the bottom of the acetabulum and the center of the iliac fossa, are usually semitransparent and composed entirely of compact bone; second, the internal and anterior sloping of the internal iliac fossa with its termination at the ileopectineal line is of great importance in explaining the great prevalence of abscess formation in the internal iliac fossa and the tendency to point anteriorly in Scarpa's triangle.

Etiology. Staphylococcus pyogenes aureus is the organism chiefly responsible. *Staphylococcus albus*, pneumococcus, streptococcus, and even the tubercle bacillus may occasionally be the organism. Trauma undoubtedly plays some part in osteomyelitis of the ilium.

Diagnosis. Several factors make the diagnosis of osteomyelitis of the ilium difficult. First, the patients are acutely ill, the general symptomatology frequently overshadowing the local lesion. Second, the diffuse type of the condition is situated so deeply from the surface that local palpation is not often of value. Third, the close proximity to the hip joint makes it difficult to rule out pyarthrosis of the hip. In osteomyelitis of the ilium, motion in the hip joint can be obtained of such a degree that it would be inconsistent with the diagnosis of pyarthrosis. Also the deformity of pyarthrosis of the hip is a flexion, abduction and external rotation, whereas in osteomyelitis of the ilium without pyarthrosis, the deformity tends chiefly toward flexion. Fourth, the relative infrequency of osteomyelitis of the ilium makes it hard to diagnose. In the differential diagnosis, pyarthrosis of the hip and osteomyelitis of the upper end of the femur should receive first consideration.

Pain is the outstanding symptom, and is generally felt in the hip, frequently in the region of Scarpa's triangle. The deformity is of some value in diagnosis, and is to be differentiated from that of pyarthrosis as stated above. Tenderness to palpation is of definite value in the localized marginal lesions. Rectal examination frequently discloses swelling on the affected side of the pelvis. In addition to the above findings there are of course the general findings of osteomyelitis.

In the acute case roentgen examination is

of little value, but soft tissue technique occasionally shows swelling lateral to the outer cortex of the ilium. Sequestration is seldom seen. Roentgenograms taken later in the disease show a mottled appearance with loss of sharp detail generally noted in the ilium. Later marked osteosclerosis is demonstrated. In the author's experience this usually means abscess formation lined by eburnated bone. Perforation is frequently noted on roentgen examination. Localized abscesses just above the acetabulum were demonstrated by roentgenogram in 2 of the author's cases.

Treatment. In chronic osteomyelitis of the ilium resection of both tables of the bone is advisable. It is rarely necessary to do a complete resection—removal of diseased bone is sufficient. In local subacute osteomyelitis of the ilium local resection of the involved area is sufficient. In diffuse subacute cases, complete eradication of both tables gives more certainty of complete cure. In acute osteomyelitis of the ilium localized to the marginal epiphyses, incision, drainage, and eradication of involved bone should be done. The general condition of the patient as well as the local condition must be considered in diffuse acute osteomyelitis of the ilium. Early drainage with relief of pressure alleviates the clinical symptoms of pain and toxemia and probably lessens the chance of a septicemia. This is the type of case where trephining the ilium above the acetabulum is of greatest value. If abscess formation has taken place and the patient is extremely toxic it is advisable to do nothing more than drain the abscess, leaving the more radical bone operation until a few days later. The radical operation should be done at once if the patient's condition will tolerate it. In the diffuse type with overwhelming infection where the mortality is very high resection of the ilium is indicated, since the only chance is in eradicating the involved area.

Twenty-four cases are reported in the author's series. The females outnumbered the males three to one. Seventeen of the patients were completely cured.—*W. C. Hall.*

Kienböck, R., and Selka, A. Über die Zystofibrome der Knochen. (Cystic fibromas of bone (osteitis fibrosa cystica localisata).) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 324–330.

The differential diagnostic points of this lesion are pointed out and its roentgen characteristics are illustrated. The bone is widened and the first clinical sign may be fracture which may heal spontaneously.

Multiple xanthomas of bone produce characteristic areas of destruction (which are illustrated). Expansion of the bone may be absent. Spontaneous fracture occurs late in the course of the disease.—*E. T. Leddy.*

Kay, H. D., Simpson, S. Levy, and Riddoch, G. Osteitis deformans. *Arch. Int. Med.*, Feb., 1934, *53*, 208–248.

The authors review the subject and add 34 cases of osteitis deformans to the literature.

The age incidence in their group was found to be fifty-five years, while the youngest of their cases was thirty-nine and the oldest seventy-eight years of age. Sex incidence was closely divided, 18 of which were females and 16 males. Two of the patients were familially related.

The mode of onset was insidious and usually manifest by pain (24 cases) mostly in the lower extremities and pelvis. The pain is supposedly due to periosteal distention or to static forces causing a deformity of the bones affected.

The chemical composition of the bones in Paget's disease showed an increase in organic elements and a diminution of inorganic material. The calcium content of the bones was found to be invariably low.

Blood chemistry was usually within or not far from normal limits. The authors found the phosphatase reaction to be the most indicative test of the condition and this with few exceptions was found to be elevated.

The etiologic theories have been discussed in the article and the authors concluded that the syphilitic and neurotrophic hypotheses are without foundation. They proposed the concept of a parathyroid disturbance as connected with the condition and believed that they had sufficient evidence at hand to prove that Paget's disease is caused by a disturbed function of the ductless glands.—*R. A. Berger.*

Root, Howard F., White, Priscilla, and Marble, Alexander. Abnormalities of calcium deposition in diabetes mellitus. *Arch. Int. Med.*, Jan., 1934, *53*, 46–53.

Two cases of diabetes mellitus are presented which had crushing lesions of the vertebrae and generalized decalcification. The authors briefly discuss the frequency of osteoporosis in diabetes as well as abnormal local deposits of cal-

cium and factors influencing calcium and phosphorus metabolism. The roentgen appearance of the lesions is mentioned but no reproductions accompany the article. They have seen only 2 cases of generalized osteoporosis in 12,000 cases of diabetes studied.—*R. A. Berger.*

Breitmann, M. Über die endokrinologische Diagnostik in der Röntgenologie. (Endocrinologic diagnosis in roentgenology.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 206–208.

The author points out (on the basis of over 1,000 studies) the importance to all roentgenologists of a knowledge of endocrinology, especially in the study of lesions of the osseous system.—*E. T. Leddy.*

Shelton, E. Kost, Cavanaugh, Lyman A., and Evans, Herbert M. Hypophyseal infantilism; treatment with an anterior hypophyseal extract. *Am. J. Dis. Child.*, April, 1934, *47*, 719–736.

Six cases are reported which were studied over a period of two years. The 6 children were presumed to have a secretory deficiency of the anterior hypophysis which was verified in one child. Four were treated by the intragluteal injection of a growth-stimulating fraction of the bovine anterior hypophysis. One was treated by another method. One was left untreated for twenty-three months and was then given the growth-stimulating fraction. The last 2 patients served as controls.

The growth increment of the 4 treated patients was considerably in excess of the expectancy, as computed from the average for the four previous years, and slightly in excess of the theoretical normal for their ages. It was not determined definitely whether the rate was in direct ratio to the amount of substance administered, or whether there was a difference in the potency of the filtered material (without a preservative) and the filtered material (with merthiolate). The authors believe that the increment was more rapid in the first few months of treatment than subsequently. If this is true, this may have been due to a difference in the physiological response or to a difference in the material. One child who received treatment changed in configuration and appearance. The growth increment in the 2 control cases was slightly in excess of the expectancy, but below the theoretical normal. The increment for the control case, in which the growth-stimulating fraction was given later, was in excess of the theoretical normal and several times the previous rate.

The authors conclude that growth has been stimulated in children by the intragluteal administration of a growth-stimulating fraction of the anterior hypophysis. In one dwarfed child the facial expression and configuration were changed but in its present potency, they believe, the preparation will not rehabilitate one who has fallen far behind in development, unless, perhaps, it is given in massive doses and over a prolonged period. Even in its present potency, the preparation, if administered early in the proper dose and over a sufficient period of time, may be of clinical value in certain cases of mildly arrested development and in the prevention of hypophyseal infantilism.

Roentgenograms of the wrists were made in these cases to note the epiphyseal development. In the examination of the sella turcica, the findings in the various cases were: microsella with approximation of the clinoid processes; shallow sella with absent posterior clinoids and rudimentary anterior processes; normal appearance; and in the case which had previously been operated upon for suprasellar cyst, a smooth floor of the sella with absent posterior and anterior clinoids and a calcification in the hypothalmic region.—*R. S. Bromer.*

Slavens, John, J. Multiple myeloma in a child. *Am. J. Dis Child.*, April, 1934, *47*, 821–835.

Few authentic cases of multiple myeloma in childhood have been reported in the literature. Slavens states he has kept in mind the extreme rarity of the disease and the doubt regarding its occurrence in childhood in submitting this report as an instance of multiple myeloma in a child.

Slavens' patient was a white child, four years of age. Characteristic findings of multiple myeloma were found with involvement of the spleen, liver and aortic lymph nodes. Roentgenograms showed a compression deformity of the first and second lumbar vertebrae, with irregular mottling of the bones of the pelvis, with symmetrical areas of rarefaction in each acetabulum. In the skull multiple areas of destruction were found. Later roentgen examinations showed increased destruction and rarefaction of the vertebral bodies and the pelvic bones and greater involvement of the skull. The entire spinal column became affected. The patient was given roentgen irradiation to the spinal

column and skull in an effort to relieve pain. Although he was free from pain for a short period, he became progressively weaker, with increasing pallor and, later, pain in the back and extremities. He died suddenly, after having been under observation and treatment from August, 1932, to June, 1933. In this case there was a gradual decline, despite slight remissions, to a fatal termination and the history, roentgenologic findings and necropsy point to the diagnosis of multiple myeloma.

Although MacCallum has asserted that multiple myeloma appears only in the bone marrow, involvement of the liver and spleen with tumor masses identical with those found in the bone marrow has been reported. Growths have also been found in the lymph nodes. The finding of tumor cells circulating in the blood in cases of multiple myeloma points to metastatic dissemination. On the other hand, some authors regard it as a systemic disease of hematopoietic organs and the visceral involvement as not true metastases.

Geschickter and Copeland have suggested six cardinal signs and symptoms:(1) multiple involvement of the skeletal trunk, (2) pathologic fracture, (3) Bence-Jones proteinuria in from 65 to 70 per cent of cases, (4) characteristic backache with early signs of paraplegia, (5) inexplicable anemia and (6) chronic nephritis, retention of nitrogen and hypertension.

In the case here reported the anemia became progressively worse and Bence-Jones proteinuria was never found. But the latter is not specific for multiple myeloma. Conditions to be differentiated are hyperparathyroidism with bone changes, tuberculosis of the bones, xanthomatosis, Ewing's tumor, chloroma, osteomalacia and Hodgkin's disease.

The author quotes Vance who noted that five different types of multiple myelomas have been distinguished in the literature, on the basis of the morphology of the tumor cell, as to whether it resembles (1) the myeloblast, (2) the small lymphocyte, (3) the neutrophilic myelocyte, (4) the erythroblast or (5) the plasma cell. Ewing has classified the tumor as (1) plasmacytoma, (2) erythroblastoma, (3) lymphoblastoma and (4) myelocytoma, depending upon the characteristics of the predominating cell. Whether the condition should be classified as of four types or whether it is one of varying grades of anaplasia in a single cell is still undetermined, but according to Ewing the former view seems to be in favor at present.

Treatment of the condition is palliative and consists of measures to improve the general condition, rest to prevent pathologic fractures and high voltage roentgen therapy in an attempt to allay the pain. The prognosis is hopeless as the patients do not live more than two years.—*R. S. Bromer.*

De Santo, Dominic A. Ewing's tumor (primary intracortical and subperiosteal lymphangioendothelioma). *Arch. Surg.*, Jan., 1934, *28*, 66–82.

The subject of endothelioma of the bones and endothelial tumors in general is in great confusion as regards terminology and classification. The diagnosis of Ewing's tumor is undoubtedly being made many times when it is not justified. Although Ewing was not the first to describe endothelial tumors of bone, he was the first to present a large series of cases. He summarized his findings as follows: (1) the tumor occurs in young persons from fourteen to nineteen years of age; (2) the bones affected are the tibia, ulna, ischium, parietal bones and scapula; (3) the tumors grow slowly and are often painful and tender; (4) the roentgenogram is characteristic, the tumor showing widening of the shaft without bone production, and involving a large portion or the whole of the shaft without involving the ends of the bones; (5) the tumors are radiosensitive. These conclusions were drawn in 1921, and since then it is generally recognized that absence of production of bone is not a characteristic feature of the tumor. In fact, the majority show osseous formation. To regard Ewing's tumor as a primary osteolytic tumor of the medullary cavity, as is often done, is erroneous and has been responsible for many mistakes in roentgen diagnosis.

The uncertainty which surrounds the origin and nature of Ewing's tumor is expressed by the great variety of names by which it is known. Connor places the primary site of the tumor in the marrow cavity. Kolodny believes in an origin from multicentric foci in the medulla and cortex which soon coalesce. Geschickter and Copeland believe in a primary subperiosteal or intracortical origin with secondary and minimal medullary invasion. This is in strict though not absolute contradiction to the original views of Ewing, who chose the name

endotheliomyeloma in order to indicate either a medullary origin or a preponderance of medullary involvement.

The author reports a case in which a thorough pathological study was made at autopsy, and in which he feels sure that the histologic picture was such as to permit tracing the tumor to its site of origin. The case was that of a five year old boy who had the tumor in the left tibia, and who died of extensive metastases. There could be little doubt that the growth was an example of Ewing's tumor. The age of the patient, the clinical history and the characteristic error in diagnosis (osteomyelitis), the gross characteristics, particularly the limitation to the shaft without involvement of the epiphysis, and the invasion of the Haversian systems and of the marrow cavity, with reactive formation of bone and fibrosis, all seemed typical. The old idea of an osteolytic tumor located in the midshaft of a long bone should undoubtedly be abandoned.

The author says that there can be no doubt that the tumor in this case originates spontaneously from the endothelium of lymph vessels, since a direct continuity is established between seemingly normal dilated lymph spaces in the Haversian canals and the abnormal ones in the subperiosteal and medullary zones. Moreover, proliferating endothelium, multiple layers of endothelium and sprouts of endothelium growing out into connective tissue were frequently observed. Further the tumor maintains its angioblastic arrangement throughout and produces a secretion of lymph fluid.

He feels that the tumor in the case reported is derived from the perivascular lymphatic endothelium lying in the Haversian spaces and in the subperiosteum, and that this probably represents the site of origin of Ewing's tumor in all cases. Certainly such a hypothesis would explain the early destruction of the Haversian system, which is pathognomonic. A medullary origin would seem less likely, for the reason that no one has ever demonstrated the presence of lymphatic endothelium in the bone marrow, and because the bulk of the clinical and histologic evidence is contrary to the existence of lymphatics in the bone marrow.— *W. C. Hall.*

Eisenheimer, A., and Wolf, Jos. Über einen Fall von Morbus Gaucher (ossuärer Typ). (A case of Gaucher's disease.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 222–224.

A report of a patient, aged forty-two, who was first diagnosed sciatica, then coxitis, splenomegaly and abdominal tuberculosis. Splenectomy produced no effect on the destruction of both hip joints. Roentgenograms of the femurs gave positive Fischer's signs only in the anteroposterior view, while the lateral films did not and the condyles were not enlarged. The authors therefore feel that Fischer's sign must not be considered a "flask-shaped" widening of the lower end of the femurs but as a "lateral apposition" of the bones.—*E. T. Leddy.*

Gaál, Andreas. Das Röntgenbild der Knochenveränderungen bei essentieller Xanthomatose (Diathesis xanthomatosa). (A roentgen study of the bone changes in essential xanthomatosis (diathesis xanthomatosa).) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 292–298.

The changes noted in the case reported were smoothly outlined oval or round thinned out areas sometimes confluent and irregularly distributed and correspond to the irregularities that can be palpated clinically. These changes are probably a pressure atrophy or a trophic atrophy from interference with the nutrient artery of the bone. There seems to be no intraosseous cause for these changes which therefore differ from those in the Schüller-Christian type of lipoidosis.—*E. T. Leddy.*

Claessen, Gunnlaugur. Roentgenologic characteristics of echinococcus disease in bones. *Acta radiol.*, 1934, *15*, 178–192.

The author describes 4 cases of echinococcus cysts in bones and discusses the roentgen findings. Echinococcus cysts in bone constitute from 1 to 2 per cent of all cases of echinococcus disease. The most frequent localization is in the bones of the pelvis but there is hardly any bone in the skeleton that has not been involved in some cases. The author's cases were in the iliac bone and head of the femur, the sacrum, the diaphysis of the femur and the fibula. The echinococcus infiltrates the spongy substance of the bone and attacks the cortex. The cases are frequently complicated by infection, suppuration and spontaneous fracture. The destruction in some cases may resemble that of malignant tumor but in most cases it is more benign. Important points in differential diagnosis are that there is no regional atrophy of the bone and no reaction on the part of the periosteum. The author discusses the differ-

ential diagnosis of echinococcus cysts from surgical tuberculosis, osteosarcoma and fibrous cystic osteitis. The boundaries of the echinococcus cyst can rarely be determined definitely from the roentgenogram.—*Audrey G. Morgan.*

Pellini, Maria. Non comune quadro radiografico in due casi di tubercolose ossea a localizzazioni multiple. (Unusual roentgen picture in two cases of multiple bone tuberculosis.) *Radiol. med.*, Feb., 1934, *21*, 97–118.

The author describes the clinical and roentgen picture of 2 cases of bone tuberculosis, one in a little girl two years of age and the other in a boy seven months of age. There were tuberculous lesions in almost all the bones of the skeleton. The lesions, while they varied greatly in appearance, were all characterized by lack of atrophy in the zones adjacent to the osteolytic foci, by the predominance of bone sclerosis over bone destruction and by the fact that there was a distinct ossifying periostitis in several layers in the metaphyses and diaphyses. The roentgen pictures were so unusual that the diagnosis of tuberculosis was doubted but it was proved by bacteriological and serological examination.

These 2 cases emphasize the fact that in children up to nine to twelve years of age tuberculosis cannot be diagnosed as it can in adults by the classical roentgen findings that are described in the texts. In these cases the diagnosis must be made from clinical and laboratory findings rather than by roentgenology, because bone tuberculosis presents the most varied roentgen pictures and very frequently resembles gumma or chronic osteomyelitis.—*Audrey G. Morgan.*

Miller, L. F., and Rubell, I. Transverse bands in the bones of a tuberculous child. *Am. J. Dis. Child.*, Feb., 1934, *47*, 354–359.

Miller and Rubell report the case of a white boy, aged nine, whose roentgenograms showed dense transverse lines or zones, symmetrically placed in almost all the long bones. The bands appeared most marked in the lower ends of the femurs, the upper end of the tibias and fibulas, the lower end of each radius and ulna, and the pelvis. In the pelvis, vertebrae and the epiphyses, the bands corresponding to the transverse bands in the diaphyses lay just inside the outer margins of the centers of ossification and were curved in exactly the same manner as the outlines of these centers. In the long bones where the growth is slower, the bands lay close to the cartilage. The bands were parallel to the ends of the long bones and the distance between them varied according to the growth of that portion of the bone, and the width of the bands appeared to vary with the size of the bone. Only three centers were visible in the roentgenograms of the carpal bones, indicating that some injury to the skeletal development occurred between the ages of two and three years.

The patient had a tuberculous arthritis of the hip joint. Bands such as described have been regarded as caused by deficiency diseases, such as rickets, scurvy or any chronic debilitating condition. Administration of phosphorus may also cause them. No phosphorus had been given this child. As Eliot, Souther and Park have stated, the transverse lines are caused by modifications of growth of the bones. The authors do not consider that this case offers definite proof that a correlation of tuberculosis with the formation of the bands exists, but they believe, however, that in this patient in whom no evidence exists other than a known tuberculosis of the hip joint, there may be a definite relationship between the two.—*R. S. Bromer.*

Schor, M. I., and Heinismann, J. I. Über kondensierende Prozesse im Knochensystem. (Condensing processes in bone.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 440–445.

The authors describe the clinical and roentgen findings in 2 cases of early melorheostosis. In their opinion a third case also illustrated is an idiopathic form of a condensing process in bone.—*E. T. Leddy.*

Liebremann, Benno. Die Ausheilungsstadien malazischer Prozesse und sogenannter aseptischer Nekrosen. (The healing processes in malacic disease and so-called aseptic necrosis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 435–439.

The author shows some roentgenograms of the stages of healing of the malacic diseases of bone (Köhler's disease of the navicular bone of the foot, Perthes' disease, coxa vara) which show that complete anatomic repair of these lesions can take place.—*E. T. Leddy.*

Fava, Cesare. Contributo allo studio del morbo di Sprengel. (Sprengel's disease.) *Arch. di radiol.*, 1933, *9*, 1024–1036.

Congenital high scapula was first described by Eulemberg in 1862 but did not become well

known until Sprengel's monograph on it in 1891. The author describes a case in a child eleven months of age. This is the youngest patient that he knows of. Most of the cases have been in children five years of age or more. Only about 200 cases have been published. This child, in addition to a congenital high position of the left scapula, showed bridges of bone connecting the scapula with the 5th, 6th and 7th cervical vertebrae. There were also rachitic changes of the epiphyses of the femur, tibia, radius and ulna. Probably the intrauterine cause which had produced the new formations of bone had also caused a disturbance of ossification in extrauterine life. The new bone formations seemed to follow the course of the rhomboid muscle. The author thinks it probable that small bits of cartilage detached from the scapula or the cervical column became embedded in the muscle and led to abnormal ossification.—*Audrey G. Morgan.*

Müller, W. Umbauzonen an den Dornfortsätzen kyphotischer Wirbelsäulen als Ursache von Schmerzzuständen. (Proliferations around the spinous process of kyphotic spines as a cause of pain.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 639–641.

In the majority of cases of kyphosis in the adult there is a proliferation of bone around the spinous processes at the apex of spinal curvature. The zones of transverse bands of greater translucence are due to the traction exerted by the ligaments which are attached to the apophysis and the effect of which is increased by the kyphosis and are analogous to hypertrophic changes elsewhere, such as for example in the upper patella, by excess traction on the patella by the patellar ligament.—*E. T. Leddy.*

Baastrup, C. I. Proc. spin. vert. lumb. und einige zwischen diesen liegende Gelenkbildungen mit pathologischen Prozessen in dieser Region. (The lumbar spinous processes, some of their joint formations and pathological conditions in this region.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 430–435.

Changes in the posterior spinous process of the vertebrae often give rise to painful conditions. In cases of lordosis these processes may press on each other to a considerable degree. Between the processes there are interspinous ligaments and often, actual joints. In case of chronic pressure the ligaments are injured or even destroyed. In acute pressure there may result a hematoma or hemarthrosis which gives pain. As a further course typical osteoarthritic changes may take place. These changes are usually accompanied by no changes in the vertebral bodies. As secondary symptoms there may be marked lumbar lordosis, dislocation of the hip, adiposity or tuberculous changes. These are of importance in cases of spondylitis deformans, spinal fractures, spondylolisthesis, Paget's disease, etc. The treatment is surgical—*E. T. Leddy.*

Bistolfi, Stefano. Ulteriori osservazioni sulle ossificazioni post-traumatiche para-malleolari, con speciale riguardo alla diagnosi differenziale colle fratture parcellari. (Recent cases of post-traumatic paramalleolar ossification with special reference to differential diagnosis from comminuted fracture.) *Arch. di radiol.*, 1933, *9*, 1061–1081.

In a previous work the author described 30 cases of post-traumatic paramalleolar ossification and tried to show its relationship to the joint ligaments. In this article he describes some additional cases with special reference to differential diagnosis from fracture, which may be of medicolegal importance. The differential diagnosis is not really difficult if the roentgenologist is familiar with the picture of post-traumatic paramalleolar ossification, but as many clinicians are not familiar with it this study has its practical value. Two cases of ossification on the external side of the malleolus are described and 2 cases of posterior ossification and the differences from fracture shown by means of illustrative roentgenograms.—*Audrey G. Morgan.*

Volkmann, J. Das Os subtibiale. (Os subtibiale). *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1933, *48*, 225–227.

The os subtibiale is a rare accessory bone, or a center of ossification or a sesamoid bone in the calcaneo-tibial ligament, and is to be differentiated from fracture. It may be unilateral or bilateral. There are no systematic studies avialable of its occurrence or anatomical nature.—*E. T. Leddy.*

Masturzi, Antonio, L'osteocondromatosi articolare di Reichel. (Reichel's osteochondromatosis of the joints.) *Arch. di radiol.*, 1933, *9*, 970–1005.

Reichel was the first in 1900 to give a complete description of this disease showing that

the cartilaginous bodies originate in the joint synovia. It affects the knee joint most frequently, less frequently the elbow and hip and rarely the shoulder and ankle. About 75 per cent of the cases are in men from twenty to forty years of age. There are many cartilaginous or osteocartilaginous bodies in the serous cavities of the joint, varying in size from that of a millet seed to that of an orange. They develop slowly and generally in only one joint. There are four theories as to their origin—the infectious theory, the traumatic theory, the embryological theory and that of neoplasm.

At first there are only small nodes of cartilage or extensive cartilaginous plaques on the inner surface of the joint capsule; as the process develops there are pedunculated and then free bodies in the joint cavity. In rare cases there are cartilaginous new formations on the compact external layer of the joint capsule. Microscopic examination shows the bodies made up of hyaline cartilage, ossified in places. Sometimes necrosis and formation of mucus takes place in the center. There are no signs of inflammation.

The beginning of the disease is slow and gradual. The patients generally attribute it to trauma. As it progresses joint function is more or less seriously interfered with. The synovia gradually thickens and sometimes there is an effusion. There are alternate periods of improvement and exacerbation.

Differential diagnosis is impossible clinically and roentgen examination is therefore indispensable. The roentgen picture is described with differential points from the different diseases with which it may be confused, including arthritis deformans, König's osteochondritis dissecans, tuberculous synovitis, free joint bodies in tabes, syphilitic osteochondritis, tophi from gout and periarticular osteomata. Ten cases are described and illustrated with roentgenograms.

In all of these cases except two there was a history of trauma which is without doubt at least one factor in the causation of the disease. Only one case showed signs of arthritis deformans of the joint surfaces but only in the zone which was in contact with the free joint bodies, while other parts were free. In one case there had been an inflammatory process immediately after a trauma but it had been limited to a small part of the margin of the joint cavity and had evidently not caused the many free joint bodies. There were no signs of arthritic changes in the other joints.

An extensive bibliography of the subject is given.—*Audrey G. Morgan.*

GENERAL

Faure-Beaulieu, M., Lyon-Caen, L. and Brunel, M. Maladie d'Addison à symptomatologie fruste et à evolution prolongée. (Addison's disease of indefinite symptomatology and prolonged evolution.) *Presse méd.*, March 21, 1934, *42*, 453–455.

The authors describe an unusual case of Addison's disease in which a definite diagnosis was possible only after roentgen examination demonstrated the presence of calcifications in the region of the suprarenal glands. In résumé, the case presented for a period of thirteen years a syndrome of asthenia, loss of weight, digestive disorders and melanodermia. On the basis of this a diagnosis of Addison's disease was made in the beginning. At the last examination, however, the melanodermia was found to have disappeared, there was no arterial hypertension and the remaining symptoms were so indefinite that the former diagnosis of Addison's disease was considered doubtful. Laboratory tests such as the blood sugar determination, the interferometric examination of the serum, etc., likewise failed to furnish any additional information. Finally, a roentgen examination of the suprarenal region demonstrated definite evidence of calcifications suggestive of an old tuberculosis of the adrenal glands.—*T. Leucutia.*